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Low Takeoff Rotation Speed Commuter Type Aircraft Aerodynamic Performance of Type II and Type IV Fluids

August 2003

Final Report

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16. Abstract

Type II and Type IV aircraft ground anti-icing fluids are currently used on commuter type aircraft, although they are being certified to AMS1428 Annex B, which corresponds to aerodynamic acceptance test for large transport type jet aircraft whose takeoff rotation speeds generally exceed 100 to 110 knots. Some aircraft manufacturers have indicated certain performance adjustments or other commuter type operational procedures to be followed for selected aircraft when operators employ these Type II and IV fluids.

At the request of the Federal Aviation Administration (FAA) William J. Hughes Technical Center, the Anti-icing Materials International Laboratory conducted AMS1428D Annex C Flat Plate Elimination Tests (FPET) for commuter type aircraft to ascertain their level of performance. The aerodynamic acceptance tests were conducted at three temperature intervals for two Type II fluids and three Type IV fluids in their neat, 75/25, and 50/50 dilution forms.

A deicing and anti-icing fluid is considered acceptable at a test temperature if none of the independent boundary layer displacement thickness measurements are greater than the acceptance criteria defined by the military fluid that is tested simultaneously. The results showed that all the 50/50 dilutions are acceptable for the low-speed ramp down to -10°C, the lowest temperature tested due to freeze-point restrictions. Three of the five 75/25 dilutions are acceptable for the low-speed ramp down to -10°C; below this temperature none of the fluids were acceptable. For the two other fluids, one was acceptable only at 0°C, the other was not acceptable at any temperature. For the fluids in their neat form, only one was acceptable at 0°C. For all other fluids, the neat FPET results were greater than the acceptance criteria.

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LIST OF ACRONYMS

AMIL	Anti-icing Materials International Laboratory
FAA	Federal Aviation Administration
AMS	Aerospace Material Specification
BLDT	Boundary Layer Displacement Thickness
FPET	Flat Plate Elimination Test
W.C.	Water Change (%)

EXECUTIVE SUMMARY

Type II and Type IV aircraft ground anti-icing fluids are currently used on commuter type aircraft, although they are being certified to AMS1428 Annex B, which corresponds to aerodynamic acceptance test for large transport type jet aircraft whose takeoff rotation speeds generally exceed 100 to 110 knots. Some aircraft manufacturers have indicated certain performance adjustments or other commuter type operational procedures to be followed for selected aircraft when operators employ these Type II and IV fluids.

At the request of the Federal Aviation Administration William J. Hughes Technical Center, the Anti-icing Materials International Laboratory conducted AMS1428 Annex C Flat Plate Elimination Tests (FPET) for commuter type aircraft to ascertain their level of performance. The aerodynamic acceptance tests were conducted at three temperature intervals for two Type II fluids and three Type IV fluids in their neat, 75/25, and 50/50 dilution forms.

A deicing and anti-icing fluid is considered acceptable at a test temperature if none of the independent boundary layer displacement thickness measurements are greater than the acceptance criteria defined by the military fluid that is tested simultaneously. The results showed that all the 50/50 dilutions are acceptable for the low-speed ramp down to -10°C, the lowest temperature tested due to freeze-point restrictions. Three of the five 75/25 dilutions are acceptable for the low-speed ramp down to -10°C, below this temperature none of the fluids were acceptable. For the two other fluids, one was acceptable only at 0°C, the other was not acceptable at any temperature. For the fluids in their neat form, only one was acceptable at 0°C. For other fluids tested in their neat form, results were greater than the acceptance criteria.

1. INTRODUCTION.

Type II and Type IV aircraft ground anti-icing fluids are currently used on commuter type aircraft, although they are only being certified to AMS1428D [1] Annex B, which corresponds to aerodynamic acceptance test for large transport type jet aircraft whose takeoff rotation speeds generally exceed approximately 100 to 110 knots. Some aircraft manufacturers have indicated certain performance adjustments or other commuter type operational procedures to be followed for selected aircraft when operators employ these Type II and IV fluids.

A test method exists for assessing the aerodynamic acceptance of anti-icing fluids on commuter type aircraft, Annex C of AMS1428; however, no fluids are tested to this specification.

At the request of the Federal Aviation Administration (FAA) William J. Hughes Technical Center, the Anti-icing Materials International Laboratory (AMIL) conducted AMS1428 Annex C Flat Plate Elimination Tests (FPET) of selected Type II and Type IV deicing and anti-icing fluids for commuter type aircraft to ascertain their level of performance.

1.1 OBJECTIVE.

The objective was to determine the aerodynamic acceptance of Type II and IV fluids when tested according to Annex C of AMS1428 for commuter type aircraft.

1.2 SCOPE.

Flat Plate Elimination Testing according to Annex C of AMS1428D [1] were conducted at three temperature intervals for two Type II fluids and three Type IV fluids in their neat, 75/25, and 50/50 dilution forms.

2. TEST DESCRIPTION.

2.1 FLAT PLATE ELIMINATION TEST OF AMS1428 ANNEX C.

This test is designed to measure the boundary layer displacement thickness (BLDT), which is related to lift loss on commuter type aircraft when no compensating measures are taken into aircraft takeoff procedures and takeoff rotation speeds generally exceed approximately 60 knots [2]. The flat plate setup consists of a duct (figure 1) inserted in the test section of AMIL's cold wind tunnel (figure 2). In this tunnel, the airflow and the fluid can be maintained at a constant temperature, between 5°±1°C and -45°±2°C.

The FPET procedure consists of submitting a 2-mm-thick layer of anti-icing fluid covering the test duct floor to an accelerating air flow of 2.1 m/s², simulating an aircraft takeoff (figure 3). This test is commonly referred to as the low-speed ramp as opposed to the high-speed ramp test of AMS1428 Annex B concerning FPET for large jet transport type aircraft. The BLDT on the flat plate is measured at pressure tap location P3 (figure 1) 20 seconds after the beginning of the simulated takeoff. A detailed description of this test is presented in Annex C of AMS1428D [1].

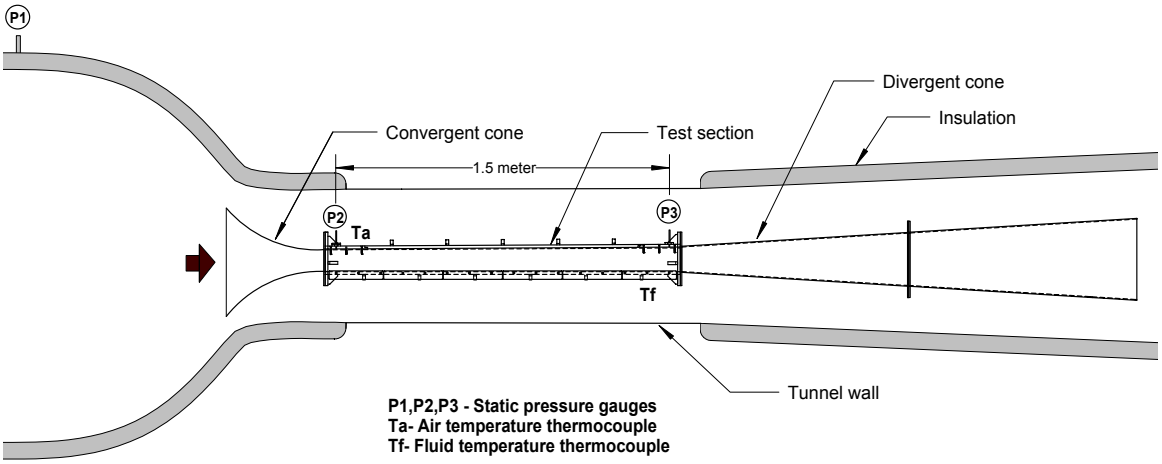
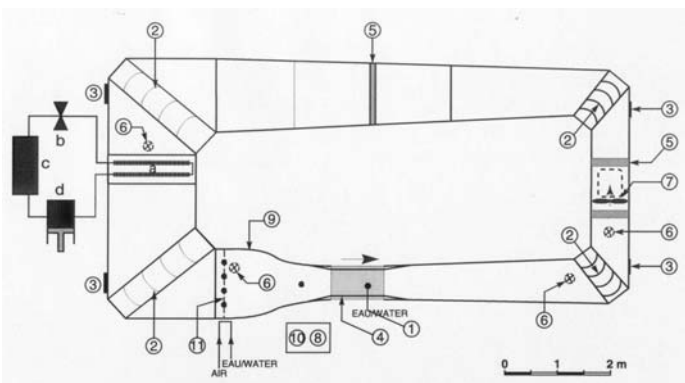


FIGURE 1. TEST SECTION BOX IN WIND TUNNEL



1	SECTION D'ESSAI TEST SECTION		SYSTÈME DE RÉFRIGÉRATION REFRIGERING SYSTEM
2	DÉFLECTEURS DE COIN CORNER VANES	a	ÉVAPORATEUR EVAPORATOR
3	PORTES D'ACCÈS ACCESS DOORS	b	SOUPAPE DE DÉTENTE EXPANSION VALVE
4	PANNEAUX D'ACCÈS ACCESS PANELS	c	CONDENSEUR CONDENSOR
5	JOINTS FLEXIBLES THERMAL EXPANSION JOINTS	d	COMPRESSEUR (75 hp) COMPRESSOR (75 hp)
6	DRAINS DRAINS		
7	MOTEUR ET VENTILATEUR FAN AND MOTOR		
8	PANNEAU DE CONTRÔLE MOTOR CONTROL PANEL		
9	CONVERGENT CONTRACTION CONE		
10	CONSOLE DE CONTRÔLE CONTROL CONSOLE		
11	GICLEURS SPRAY NOZZLES		

FIGURE 2. LUAN PHAN REFRIGERATED WIND TUNNEL

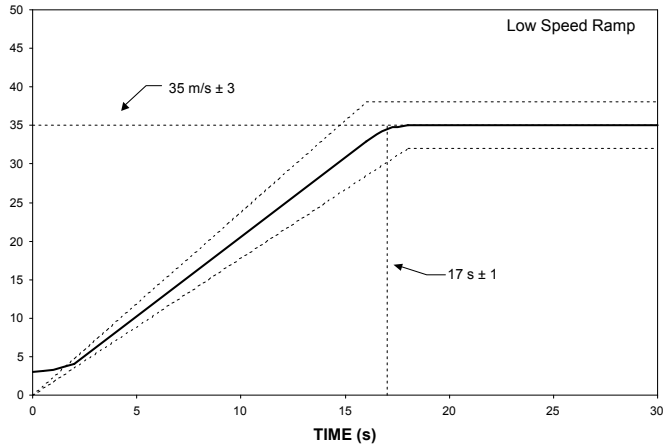


FIGURE 3. TAKEOFF GROUND ACCELERATION SIMULATION

2.2 MEASUREMENTS.

In an 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 second following 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:

- refractive index of the fluid, which is used to determine the water change (percent).
- fluid film thickness (µm) at the beginning and at the end of the FPET to compute fluid elimination (percent).

2.3 CALIBRATION AND ACCEPTANCE CRITERIA.

The calibration is obtained from dry tests, performed without fluid, and reference fluid tests using a 75/25 dilution of the reference military deicing fluid, MIL-A-8243D, for which BLDT results are well documented. The BLDT values obtained from a dry, without fluid, test should be 2.8 ±0.4 mm. For dry and calibration tests, the BLDT values are recorded at four temperature intervals: 0°, -10°, -20°, 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 are greater than the acceptance criteria.

3. TEST RESULTS.

3.1 TEST FLUIDS.

The fluids evaluated in this study are presented in table 1. For this study, two Type II and three Type IV representative certified fluids were selected. They are the same fluids used in the aerodynamic flow-off performance study conducted concurrently by AMIL for the FAA under contract DTFA-0302-P10157.

Tests were conducted at three temperature intervals for each dilution, as per AMS1428 Annex C [1]. For the neat fluid, the intervals were 0°, -10°, and -20°C. The dilutions, however, were tested at warmer temperatures due to freeze-point restrictions and the undesirability of running tests near the fluid's freezing point. Therefore, the 75/25 dilutions were tested at 0°, -10°, and -15°C (or -20°C where freeze-point restrictions allowed for it), and the 50/50 dilutions were tested at 0°, -5°, and -10°C.

TABLE 1. FLUID IDENTIFICATION

Company Name	Product	Type	Color	AMIL Label	Recep. Date
Kilfrost Limited	ABC-3 Lot # H/296/2/02 NEAT	II	Colorless	E607	02-03-21
Kilfrost Limited	ABC-3 Lot # H/296/2/02 75/25	II	Colorless	E608	02-03-21
Kilfrost Limited	ABC-3 Lot # H/296/2/02 50/50	II	Colorless	E609	02-03-21
Clariant GmbH	Safewing MPII 1951 Lot # DEGE144062 NEAT	II	Colorless	E618	02-03-22
Clariant GmbH	Safewing MPII 1951 Lot # DEGE144062 75/25	II	Colorless	E619	02-03-22
Clariant GmbH	Safewing MPII 1951 Lot # DEGE144062 50/50	II	Colorless	E620	02-03-22
Octagon Process Inc.	MaxFlight Lot # F-23195C NEAT	IV	Green	E583	02-03-13
Octagon Process Inc.	MaxFlight Lot # F-23195C 75/25	IV	Green	E584	02-03-13
Octagon Process Inc.	MaxFlight Lot # F-23195C 50/50	IV	Green	E585	02-03-13
SPCA	AD-480 Lot # M052 NEAT	IV	Green	E007	01-01-29
SPCA	AD-480 Lot # M052 75/25	IV	Green	E008	01-01-29
SPCA	AD-480 Lot # M052 50/50	IV	Green	E009	01-01-29
Dow Chemical Company	Ultra+ Lot # 200103528-53 NEAT	IV	Green	E629	02-03-28
Dow Chemical Company	Ultra+ Lot # 200103528-53 75/25	IV	Green	E630	02-03-28
Dow Chemical Company	Ultra+ Lot # 200103528-53 50/50	IV	Green	E631	02-03-28
Octagon Process Inc	MIL-A-8243D Lot # F-21340-C 75/25 dilution	-	Colorless	M-031	01-03-19

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 military fluid. According to specifications [1], the AMIL system is considered adequately calibrated, since the dry-test BLDT value (δ^*) varies within the standard range of 2.8 ±0.4 mm. As mentioned in section 2.3, dry and reference fluid BLDT values are used to compute the criteria of acceptance, presented in figures 4 and 5. The acceptance envelope is a constant straight line with a BLDT equal to the value D20. The D20 is calculated accordingly to AMS standard.

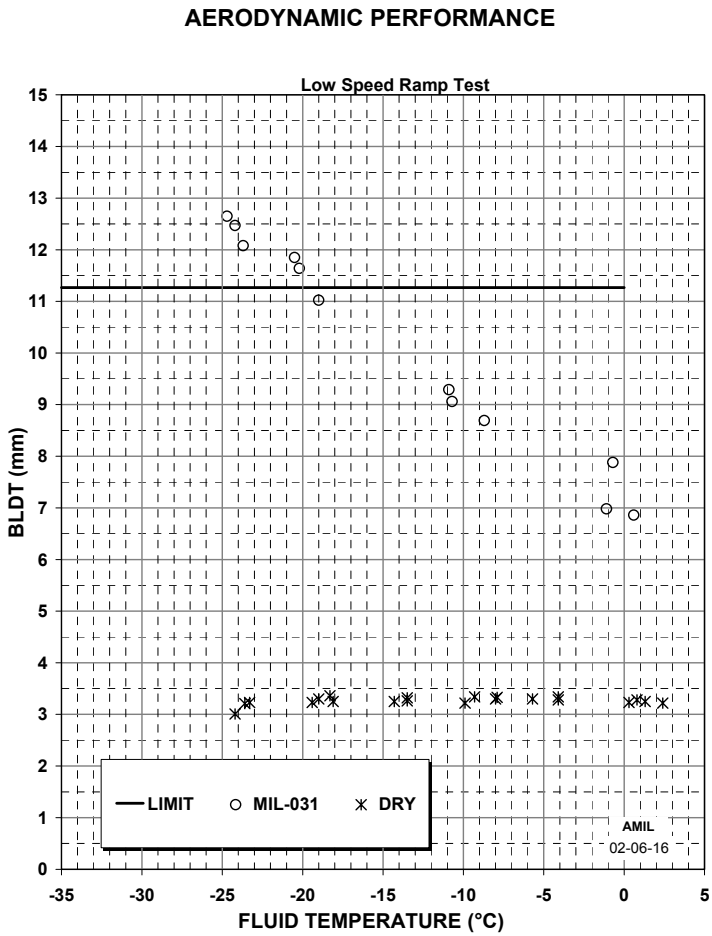


FIGURE 4. ACCEPTANCE CRITERIA FOR THE TYPE II FLUID TEST SERIES

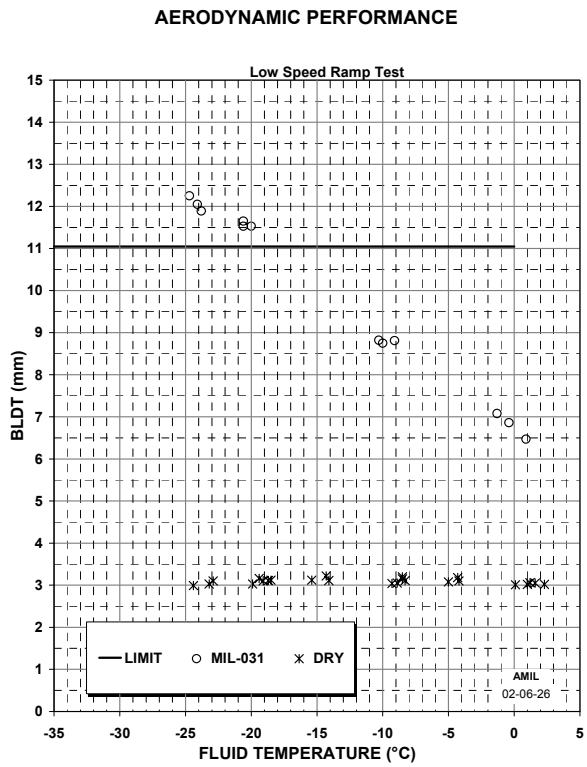


FIGURE 5. ACCEPTANCE CRITERIA FOR THE TYPE IV FLUID TEST SERIES

Since there were a large number of fluids and dilutions to be tested for this study, the tests were split into two series: one for the Type II fluids and one for the Type IV fluids. Their acceptance criteria are calculated as follows:

Calculation of acceptance level at -20°C for the Type II fluid test series:

$$D20 = (1.12 \times \delta^*_{ref}) - 0.19\left(\delta^*_{ref} - \delta^*_{dry}\right)_{-20} \tag{1}$$

$$D20 = (1.12 \times 11.45) - 0.19 \times (11.45 - 3.26) = 11.26 \text{ mm}$$

Calculation of acceptance level at -20°C for the Type IV fluid test series:

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

$$D20 = (1.12 \times 11.25) - 0.19 \times (11.25 - 3.09) = 11.05 \text{ mm}$$

where

δ^*_{ref} = the reference BLDT value at -20°C obtained by the interpolation from a straight line fitting the reference BLDT values measured at 0°, -10°, -20°, and -25°C

δ^*_{dry} = The average of all dry BLDT values measured

The Type II tests were conducted between June 12-17, 2002, while the Type IV fluids were tested between June 26, 2002, and July 3, 2002. The difference between their respective acceptance criteria is of 0.21 mm. This small difference, representing less than 2%, is typical of the differences seen between acceptance criteria of different test runs. The variability can be due to differences in atmospheric temperatures, humidity, laboratory ambient temperature, fluid temperatures, and thickness variations. This is why the military fluid is always tested concurrently with a candidate fluid, the latter being evaluated with respect to the former, since all tunnels can show variations with time. The assumption is, then, that as the military fluid BLDT varies, the candidate fluid's BLDT will vary along with it.

3.3 TEST RESULTS—KILFROST ABC-3.

The low-speed ramp FPET results of Kilfrost ABC-3 are presented in tables 2 through 4 for the neat, 75/25, and 50/50 dilutions respectively. A graph showing the BLDT results as a function of temperature is presented in figure 6. The graph shows that all the neat and 75/25 FPET are above the acceptance criteria limit and, therefore, not considered acceptable for the low-speed ramp at any temperature according to AMS1428 Annex C. For the 50/50 dilution, all tests at each temperature interval fall below the acceptance limit and, therefore, would be considered acceptable down to about -10°C. This dilution was tested only to -10°C since it is just above the temperature at which it freezes.

Figure 7 presents the fluid elimination as a function of temperature graph for the same tests. The figure shows all the points are above 57%, the minimum elimination required by AMS1428D for Type II fluids tested in accordance with Annex C [1]. Figure 8 presents the relative humidity (r.h.) as a function of temperature graph. The graph shows all values are all in the required 70% ±30 range for the tests to be considered valid [1].

TABLE 2. AERODYNAMIC PERFORMANCE FOR KILFROST ABC-3, NEAT

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o (1) µm	t_{end} (2) µm	F.E. (3) %	W.C. (4) %	V (5) m/s	δ* mm
E-607	FP-892	0.7	-1.3	80.2	2000	490	75.5	1.04	36.5	12.76
E-607	FP-893	-0.4	-1.4	74.0	2000	424	78.8	0.35	36.2	12.71
E-607	FP-894	0.6	-1.4	81.0	2000	457	77.1	0.69	36.6	12.64
E-607	FP-916	-11.0	-10.2	69.2	2000	439	78.0	0.35	37.1	11.82
E-607	FP-917	-10.0	-10.2	73.9	2000	457	77.1	0.35	37.1	12.07
E-607	FP-918	-10.2	-10.3	72.7	2000	406	79.7	0.17	37.1	12.31
E-607	FP-942	-18.8	-19.2	60.1	2000	439	78.0	0.00	36.1	12.35
E-607	FP-940	-19.0	-19.5	57.8	1975	475	76.0	0.17	36.7	12.11
E-607	FP-941	-20.2	-19.7	54.2	2000	439	78.0	0.00	36.9	12.07

(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.

Acceptance Criteria for Type II Fluid Series: D20 = 11.26 mm

TABLE 3. AERODYNAMIC PERFORMANCE FOR KILFROST ABC-3, 75/25 DILUTION

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o(1) µm	t_{end}(2) µm	F.E. (3) %	W.C.(4) %	V(5) m/s	δ* mm
E-608	FP-896	0.6	-0.1	79.6	1975	508	74.3	-0.22	36.9	12.17
E-608	FP-897	-0.7	-0.4	74.3	2000	439	78.0	-0.44	36.3	12.24
E-608	FP-895	-0.3	-0.7	74.4	2000	457	77.1	-0.22	36.5	12.19
E-608	FP-919	-9.1	-9.5	75.0	1975	424	78.5	-0.44	36.9	13.40
E-608	FP-920	-10.3	-10.0	70.4	2000	439	78.0	-0.22	36.3	13.76
E-608	FP-921	-11.3	-10.7	72.7	2000	450	77.5	-4.41	36.5	13.86
E-608	FP-936	-15.3	-14.4	58.7	2000	577	71.2	-0.66	36.1	13.79
E-608	FP-935	-15.8	-14.7	62.3	2000	508	74.6	-0.44	36.6	14.31
E-608	FP-934	-17.5	-15.0	56.1	2000	559	72.1	-0.22	36.1	13.94

(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.

Acceptance Criteria for Type II Fluid Series: D20 = 11.26 mm

TABLE 4. AERODYNAMIC PERFORMANCE FOR KILFROST ABC-3, 50/50 DILUTION

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o(1) µm	t_{end}(2) µm	F.E. (3) %	W.C.(4) %	V(5) m/s	δ* mm
E-609	FP-900	0.9	0.1	79.4	2000	399	80.1	0.33	36.3	9.88
E-609	FP-898	0.5	0.0	78.7	2000	406	79.7	-0.33	35.4	10.60
E-609	FP-899	0.0	-0.3	78.4	2000	457	77.1	-3.00	36.7	10.28
E-609	FP-912	-5.4	-4.8	79.6	2000	406	79.7	-3.00	36.1	10.21
E-609	FP-911	-6.4	-5.3	78.9	2000	424	78.8	0.00	36.4	10.38
E-609	FP-910	-7.4	-5.8	75.7	1975	457	76.9	0.33	37.0	10.29
E-609	FP-924	-10.2	-8.3	71.2	2000	457	77.1	-1.33	36.9	11.25
E-609	FP-923	-9.6	-8.4	74.1	2000	457	77.1	-0.33	37.3	10.58
E-609	FP-922	-10.3	-9.1	73.6	1975	457	76.9	-0.33	37.1	10.72

(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.

Acceptance Criteria for Type II Fluid Series: D20 = 11.26 mm

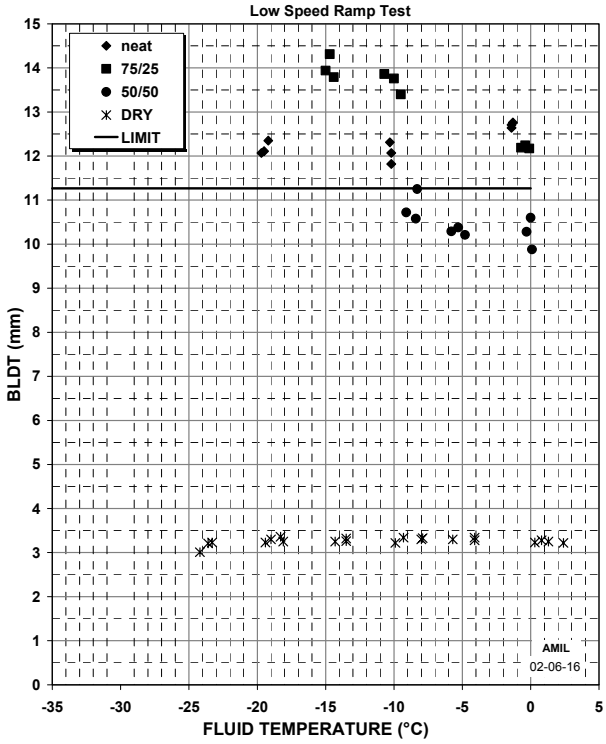


FIGURE 6. LOW-SPEED RAMP AERODYNAMIC TEST RESULTS FOR KILFROST ABC-3

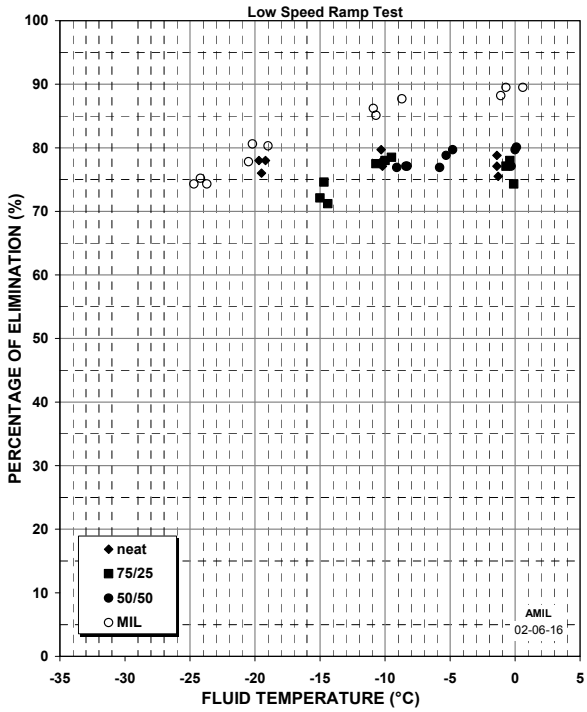


FIGURE 7. FLUID ELIMINATION FOR KILFROST ABC-3

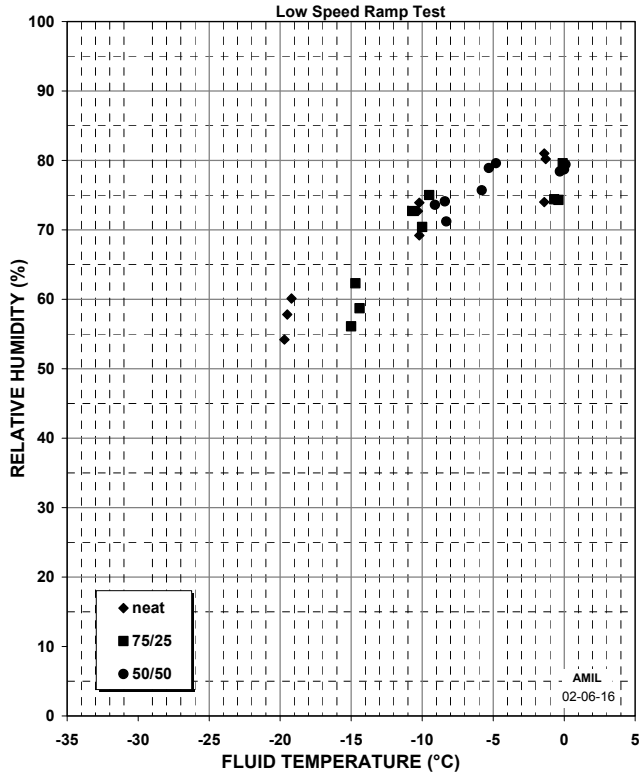


FIGURE 8. RELATIVE HUMIDITY FOR KILFROST ABC-3

3.4 TEST RESULTS—CLARIANT SAFEWING MPII 1951.

Low-speed ramp FPET results of Clariant Safewing MPII 1951 are presented in tables 5 through 7 for the neat, 75/25, and 50/50 dilutions respectively. A graph showing the BLDT results as a function of temperature is presented in figure 9. The graph shows that for the 50/50 dilution, the tests at 0°, -5°, and -10°C fall below the acceptance criteria, and therefore, this dilution would be considered acceptable down to about -10°C. For the 75/25 dilution, the tests at 0° and -10°C are below the limit; however, at -15°C they are above. Therefore, this dilution would be considered acceptable down to -10°C. The neat fluid, however, does not behave linearly: 0°C is below the limit, -10°C above, and -20°C below. According to the specification [1], this fluid would be considered acceptable at 0°C only, once the acceptance criteria limit is crossed, the fluid is no longer considered acceptable.

Figure 10 presents the fluid elimination as a function of temperature graph for the Clariant Safewing MPII 1951 tests. The figure shows that all the points are above the 57% minimum elimination requirement. Figure 11 presents the relative humidity data. The graph shows all the tests have an r.h. within the 70% ±30 range required for the tests to be considered valid.

TABLE 5. AERODYNAMIC PERFORMANCE FOR CLARIANT SAFEWING MPII 1951, NEAT

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o (1) µm	t_{end} (2) µm	F.E. (3) %	W.C. (4) %	V (5) m/s	δ* mm
E-618	FP-904	0.6	-0.4	78.8	2000	406	79.7	1.28	37.6	9.91
E-618	FP-906	0.4	-0.9	81.2	2000	406	79.7	0.73	37.2	10.02
E-618	FP-905	-0.4	-1.2	76.8	2000	373	81.3	0.92	37.0	9.91
E-618	FP-925	-10.9	-9.3	64.9	1975	475	76.0	0.00	36.8	11.48
E-618	FP-926	-10.0	-9.7	72.2	1975	475	76.0	-0.37	37.1	11.65
E-618	FP-927	-10.2	-10.0	66.6	2000	475	76.3	-0.37	37.5	11.31
E-618	FP-943	-21.4	-19.6	53.6	2000	254	87.3	-0.37	36.9	7.69
E-618	FP-944	-19.9	-19.6	59.9	2000	254	87.3	-0.37	37.1	8.10
E-618	FP-945	-20.5	-19.8	55.1	2000	279	86.0	-0.73	36.7	8.75

(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.

Acceptance Criteria for Type II Fluid Series: D20 = 11.26 mm

TABLE 6. AERODYNAMIC PERFORMANCE FOR CLARIANT SAFEWING MPII 1951, 75/25 DILUTION

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o (1) µm	t_{end} (2) µm	F.E. (3) %	W.C. (4) %	V (5) m/s	δ* mm
E-619	FP-902	0.7	0.3	81.6	2000	457	77.1	0.45	37.0	8.19
E-619	FP-901	-0.2	0.1	74.5	2000	389	80.6	0.00	37.8	8.15
E-619	FP-903	-0.3	-0.1	73.9	2000	373	81.3	-0.23	37.5	8.75
E-619	FP-928	-9.0	-9.3	76.7	1975	424	78.5	0.00	36.7	10.65
E-619	FP-929	-10.4	-9.8	67.2	1975	439	77.8	0.00	36.9	10.74
E-619	FP-930	-9.5	-9.8	74.0	1975	424	78.5	0.23	36.9	10.84
E-619	FP-937	-14.8	-13.8	59.6	1975	406	79.4	-0.90	36.2	11.71
E-619	FP-939	-15.0	-14.1	60.3	2000	432	78.4	-0.68	36.6	11.53
E-619	FP-938	-16.3	-14.3	54.7	1975	490	75.2	-1.13	36.0	11.73

(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.

Acceptance Criteria for Type II Fluid Series: D20 = 11.26 mm

TABLE 7. AERODYNAMIC PERFORMANCE FOR CLARIANT SAFEWING MPII 1951, 50/50 DILUTION

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o (1) µm	t_{end} (2) µm	F.E. (3) %	W.C. (4) %	V (5) m/s	δ* mm
E-620	FP-908	0.8	-0.2	81.6	1975	297	85.0	0.00	37.4	6.44
E-620	FP-909	-0.4	-0.4	75.0	2000	305	84.8	-0.67	38.0	6.68
E-620	FP-907	0.0	-0.6	74.9	2000	262	86.9	-1.01	37.6	6.60
E-620	FP-914	-5.1	-4.3	78.4	1975	287	85.5	-0.67	38.5	6.97
E-620	FP-913	-5.9	-4.5	72.5	1975	272	86.2	-1.01	38.8	6.92
E-620	FP-915	-6.1	-4.6	71.4	2000	279	86.0	-1.01	37.7	7.40
E-620	FP-932	-9.5	-8.1	68.4	2000	279	86.0	-0.67	37.7	7.97
E-620	FP-933	-11.0	-8.3	66.4	2000	330	83.5	-0.34	37.8	7.95
E-620	FP-931	-10.5	-8.8	64.6	2000	287	85.6	-1.01	38.0	7.78

(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.

Acceptance Criteria for Type II fluid Series: D20 = 11.26 mm

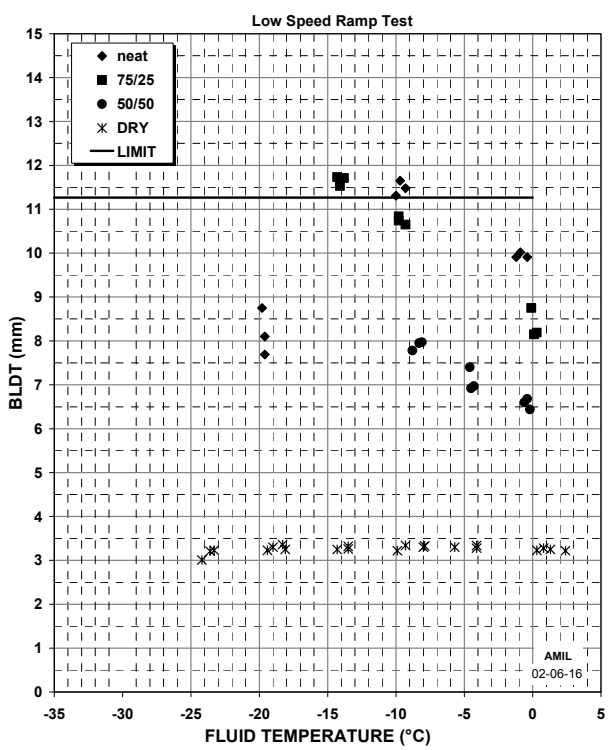


FIGURE 9. LOW-SPEED RAMP AERODYNAMIC TEST RESULTS FOR CLARIANT SAFEWING MPII 1951

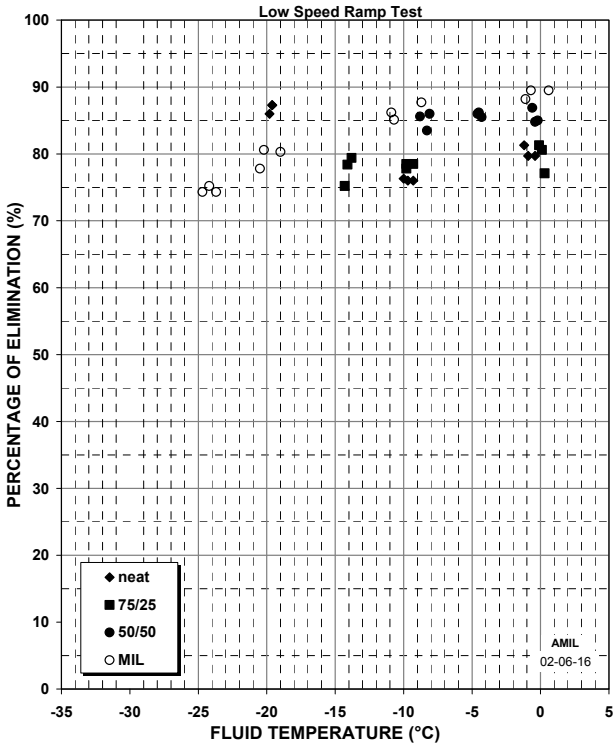


FIGURE 10. FLUID ELIMINATION FOR CLARIANT SAFEWING MPII 1951

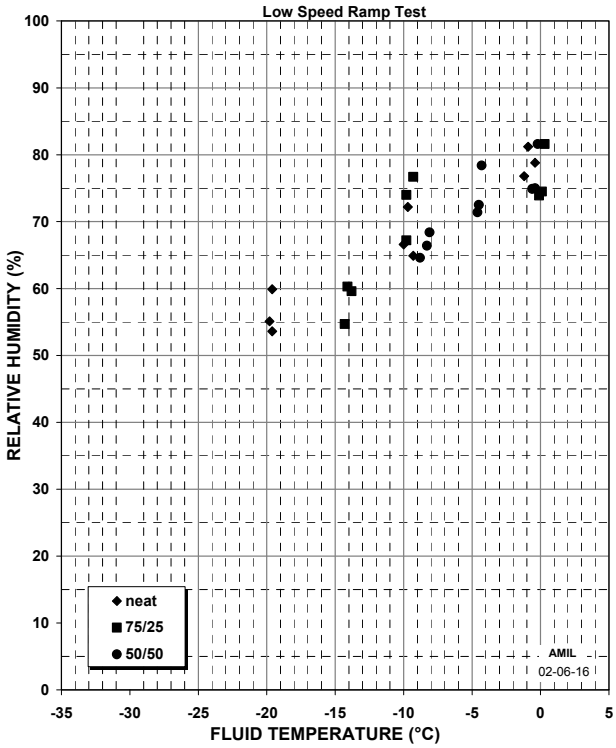


FIGURE 11. RELATIVE HUMIDITY FOR CLARIANT SAFEWING MPII 1951

3.5 TEST RESULTS—OCTAGON PROCESS MAXFLIGHT.

Low-speed ramp FPET results of Octagon Process MaxFlight are presented in tables 8 through 10 for the neat, 75/25, and 50/50 dilutions respectively. A graph showing the BLDT results as a function of temperature is presented in figure 12. The graph shows that for the neat fluid, all the FPET are above the acceptance criteria limit, and therefore, this dilution would be considered unacceptable at all temperatures for the low-speed ramp. The 75/25 dilution is only acceptable at 0°C; at -10° and -20°C, it is above the limit. For the 50/50, however, all the FPET are below the acceptance limit and, therefore, would be considered acceptable down to about -10°C.

Figure 13 shows that the percentage elimination for all tests is above the 57% minimum requirement. Figure 14 shows that the relative humidity for all tests is in the required 70% ±30 range for the tests to be considered valid.

TABLE 8. AERODYNAMIC PERFORMANCE FOR OCTAGON PROCESS MAXFLIGHT, NEAT

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o (1) µm	t_{end} (2) µm	F.E. (3) %	W.C. (4) %	V (5) m/s	δ* mm
E-583	FP-976	0.8	0.8	80.6	1975	373	81.1	1.38	35.7	12.92
E-583	FP-978	0.4	0.7	79.8	2000	490	75.5	0.52	35.8	13.10
E-583	FP-977	-0.3	0.5	76.5	1975	439	77.8	0.52	35.7	12.87
E-583	FP-004	-10.0	-8.6	62.3	2000	457	77.1	0.52	35.9	13.52
E-583	FP-005	-10.8	-8.9	61.4	2000	475	76.3	0.17	35.5	13.48
E-583	FP-006	-9.3	-9.1	67.0	2000	483	75.9	0.34	36.0	13.06
E-583	FP-039	-19.5	-19.7	58.4	1975	490	75.2	0.52	36.6	11.79
E-583	FP-040	-20.5	-19.7	55.9	1975	457	76.9	0.17	36.9	11.15
E-583	FP-038	-21.4	-20.1	53.4	1975	439	77.8	0.00	36.7	11.48

(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.

Acceptance Criteria for Type II Fluid Series: D20 = 11.26 mm

TABLE 9. AERODYNAMIC PERFORMANCE FOR OCTAGON PROCESS MAXFLIGHT, 75/25 DILUTION

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o(1) µm	t_{end}(2) µm	F.E.(3) %	W.C.(4) %	V(5) m/s	δ* mm
E-584	FP-979	0.1	0.6	77.4	2000	424	78.8	-0.22	37.2	10.84
E-584	FP-980	0.9	0.6	83.7	2000	373	81.3	-0.22	37.5	10.95
E-584	FP-981	-0.1	0.4	78.4	2000	389	80.6	-0.44	37.0	11.04
E-584	FP-008	-9.7	-8.9	67.3	2000	457	77.1	-1.74	36.3	12.06
E-584	FP-007	-11.1	-9.0	63.5	2000	457	77.1	-1.96	36.2	12.07
E-584	FP-009	-11.6	-9.9	60.7	2000	406	79.7	-0.65	36.2	12.51
E-584	FP-043	-21.0	-18.3	60.5	1975	508	74.3	-0.22	34.7	13.91
E-584	FP-042	-20.5	-18.6	58.7	1975	526	73.4	-0.22	33.7	14.02
E-584	FP-041	-22.3	-19.3	54.6	1975	508	74.3	-0.44	33.6	14.31

(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.

Acceptance Criteria for Type II Fluid Series: D20 = 11.26 mm

TABLE 10. AERODYNAMIC PERFORMANCE FOR OCTAGON PROCESS MAXFLIGHT, 50/50 DILUTION

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o(1) µm	t_{end}(2) µm	F.E.(3) %	W.C.(4) %	V(5) m/s	δ* mm
E-585	FP-982	0.5	0.4	81.3	2000	330	83.5	-0.97	35.6	8.59
E-585	FP-984	1.0	0.4	82.5	2000	356	82.2	-1.29	37.5	8.41
E-585	FP-983	0.2	0.2	80.2	2000	348	82.6	-1.29	37.3	8.52
E-585	FP-027	-5.4	-5.0	73.4	2000	373	81.3	-0.65	36.1	9.66
E-585	FP-028	-5.7	-5.1	71.1	2000	406	79.7	-0.32	35.3	9.73
E-585	FP-026	-6.4	-5.2	67.5	2000	406	79.7	0.00	36.1	9.09
E-585	FP-012	-9.5	-8.6	67.0	2000	373	81.3	-0.65	35.6	9.40
E-585	FP-010	-10.3	-9.1	64.7	2000	439	78.0	-2.90	36.9	9.46
E-585	FP-011	-11.1	-9.1	63.7	2000	389	80.6	-0.65	37.1	9.23

(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.

Acceptance Criteria for Type II Fluid Series: D20 = 11.26 mm

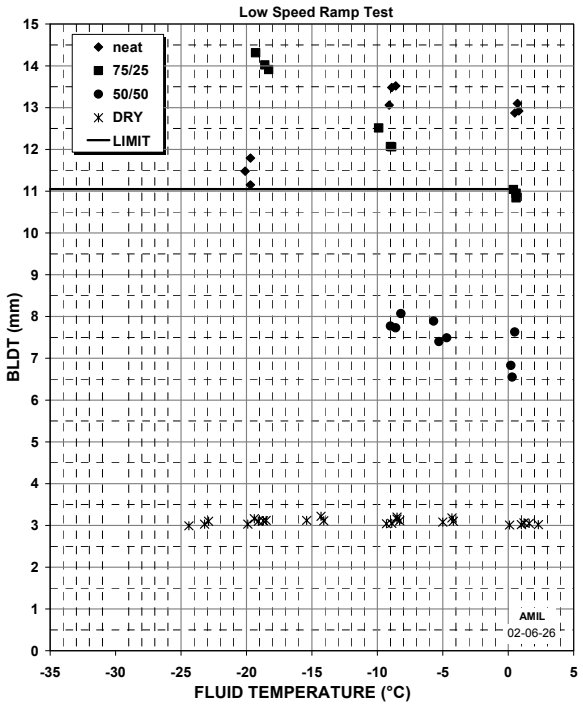


FIGURE 12. LOW-SPEED RAMP AERODYNAMIC TEST RESULTS FOR OCTAGON PROCESS MAXFLIGHT

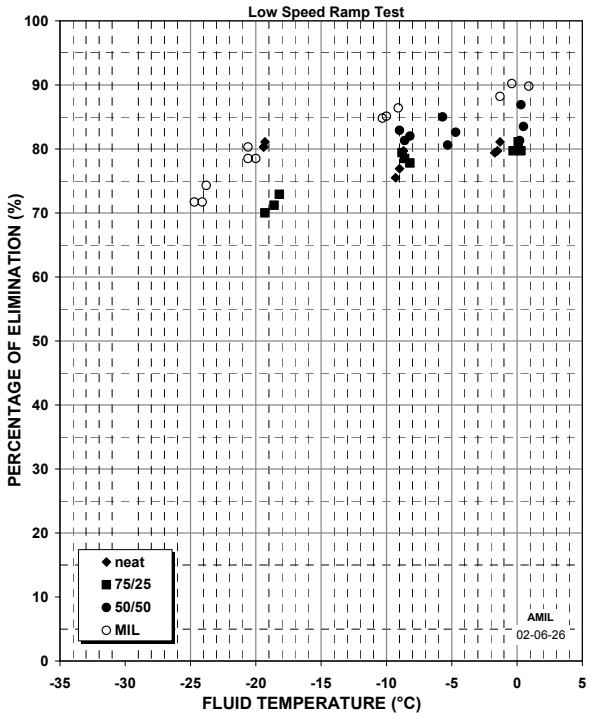


FIGURE 13. FLUID ELIMINATION FOR OCTAGON PROCESS MAXFLIGHT

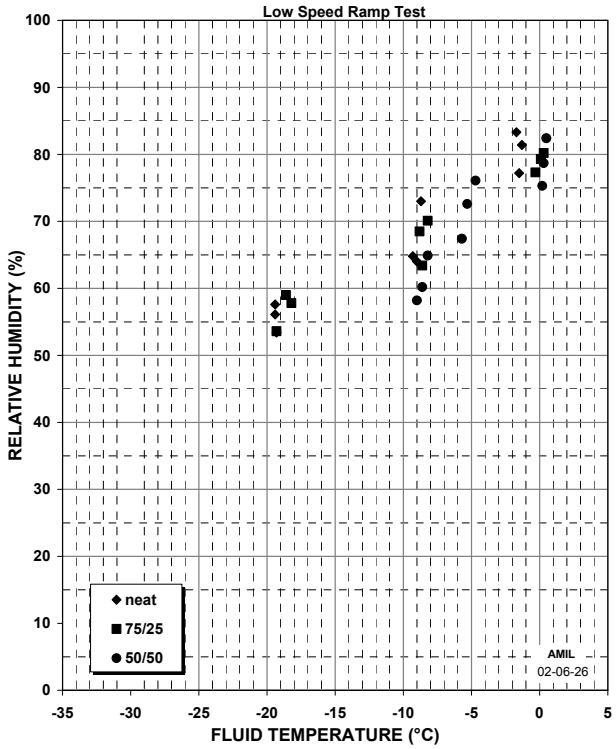


FIGURE 14. RELATIVE HUMIDITY FOR OCTAGON PROCESS MAXFLIGHT

3.6 TEST RESULTS—SPCA AD-480.

The low-speed ramp FPET of SPCA AD-480 is presented in tables 11 through 13 for the neat, 75/25, and 50/50 dilutions respectively. A graph showing the BLDT results as a function of temperature is presented in figure 15. The graph shows that for the neat fluid, the 0° and -10°C temperature interval FPET are above the acceptance criteria, while the -20°C are below. Such a fluid dilution would be considered unacceptable at any temperature for the low-speed ramp since the acceptance limit is crossed at the highest temperature. For the 75/25, the FPET at 0° and -10°C are below, while at -20°C, they are above; therefore, this dilution would be considered acceptable down to about -10°C. All the FPET tests for the 50/50 dilution, at 0°, -5°, and -10°C, are below the acceptance criteria limit, and therefore, this dilution would be considered acceptable down to -10°C.

Figure 16 shows that the percentage elimination for all tests is above the 57% minimum requirement. Figure 17 shows that the relative humidity for all tests is in the required 70% ±30 range for the tests to be considered valid.

TABLE 11. AERODYNAMIC PERFORMANCE FOR SPCA AD-480, NEAT

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o (1) µm	t_{end} (2) µm	F.E. (3) %	W.C. (4) %	V (5) m/s	δ* mm
E-007	FP-967	0.5	-1.3	81.4	1975	373	81.1	1.02	37.5	11.03
E-007	FP-968	0.4	-1.5	77.2	2000	406	79.7	1.19	36.9	11.17
E-007	FP-969	1.1	-1.7	83.3	1975	406	79.4	1.02	36.8	11.44
E-007	FP-995	-8.9	-8.7	73.0	2000	406	79.7	0.00	36.5	12.33
E-007	FP-996	-10.2	-9.0	64.0	1975	457	76.9	0.51	37.0	12.19
E-007	FP-994	-10.4	-9.3	64.8	2000	490	75.5	0.34	35.1	12.40
E-007	FP-033	-19.6	-19.3	53.4	1975	373	81.1	0.00	37.5	9.83
E-007	FP-032	-20.4	-19.4	57.6	1975	389	80.3	-0.17	36.7	9.95
E-007	FP-034	-20.2	-19.4	56.1	1975	389	80.3	-	37.1	9.91

(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.

Acceptance Criteria for Type IV Fluid Series: D20 = 11.05 mm

TABLE 12. AERODYNAMIC PERFORMANCE FOR SPCA AD-480, 75/25 DILUTION

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o (1) µm	t_{end} (2) µm	F.E. (3) %	W.C. (4) %	V (5) m/s	δ* mm
E-008	FP-972	0.7	0.3	80.2	2000	406	79.7	-0.22	37.5	9.53
E-008	FP-971	0.4	0.1	79.3	1975	373	81.1	-0.44	37.9	9.37
E-008	FP-970	-0.2	-0.3	77.3	2000	406	79.7	0.22	37.9	9.46
E-008	FP-997	-8.8	-8.2	70.1	1975	439	77.8	-0.22	37.1	11.03
E-008	FP-998	-10.3	-8.6	63.4	1975	424	78.5	0.22	37.6	10.74
E-008	FP-999	-9.0	-8.8	68.5	1975	406	79.4	0.22	37.5	10.92
E-008	FP-037	-20.9	-18.2	57.8	2000	541	72.9	0.44	33.9	13.70
E-008	FP-036	-20.3	-18.6	59.0	2000	577	71.2	-0.66	34.1	13.88
E-008	FP-035	-22.3	-19.3	53.6	1975	592	70.0	-0.44	34.3	13.74

(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.

Acceptance Criteria for Type IV Fluid Series: D20 = 11.05 mm

TABLE 13. AERODYNAMIC PERFORMANCE FOR SPCA AD-480, 50/50 DILUTION

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o(1) µm	t_{end}(2) µm	F.E.(3) %	W.C.(4) %	V(5) m/s	δ* mm
E-009	FP-974	1.1	0.5	82.4	2000	330	83.5	0.32	36.3	7.63
E-009	FP-973	0.6	0.3	78.7	2000	262	86.9	-0.32	38.3	6.55
E-009	FP-975	-0.1	0.2	75.3	2000	373	81.3	-0.32	37.7	6.83
E-009	FP-025	-4.7	-4.7	76.1	2000	348	82.6	0.00	37.6	7.49
E-009	FP-024	-5.8	-5.3	72.6	2000	389	80.6	0.00	37.0	7.40
E-009	FP-023	-7.0	-5.7	67.4	1975	297	85.0	0.00	36.3	7.89
E-009	FP-002	-9.7	-8.2	64.9	1975	356	82.0	-0.32	36.9	8.07
E-009	FP-003	-11.2	-8.6	60.2	2000	373	81.3	0.32	36.3	7.73
E-009	FP-022	-11.5	-9.0	58.2	1975	338	82.9	0.32	36.9	7.77

(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.

Acceptance Criteria for Type IV Fluid Series: D20 = 11.05 mm

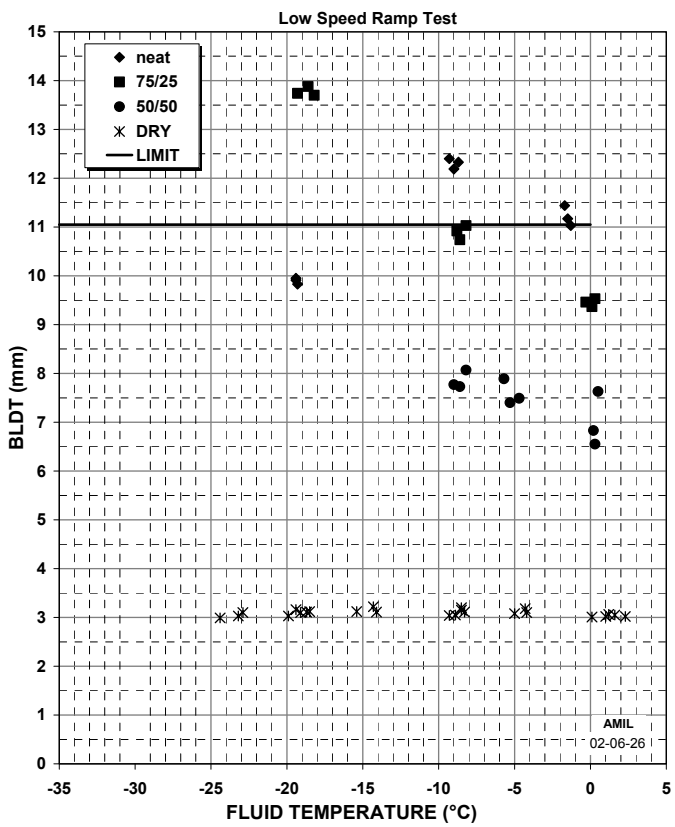


FIGURE 15. LOW-SPEED RAMP AERODYNAMIC TEST RESULTS FOR SPCA AD-480

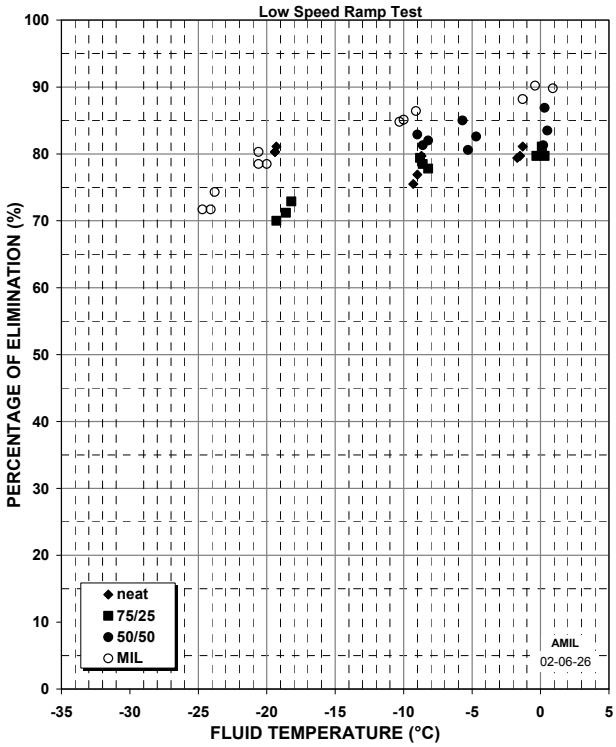


FIGURE 16. FLUID ELIMINATION FOR SPCA AD-480

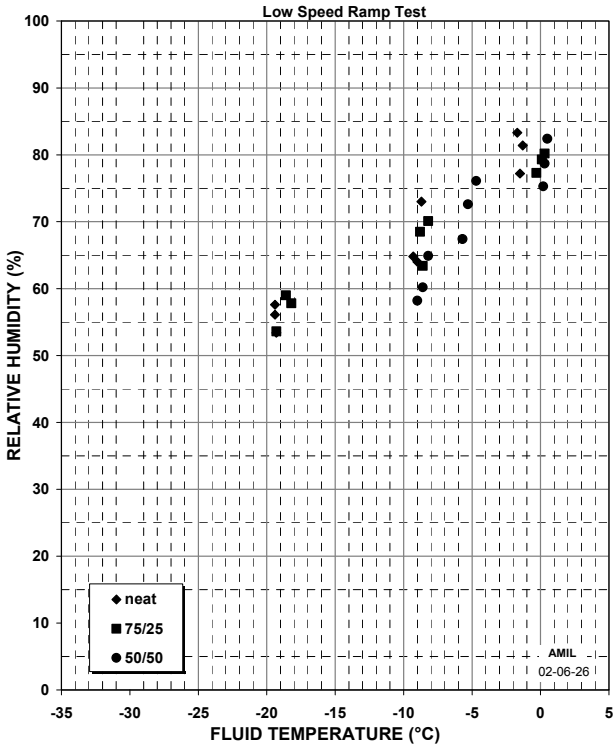


FIGURE 17. RELATIVE HUMIDITY FOR SPCA AD-480

3.7 TEST RESULTS—DOW ULTRA+.

The low-speed ramp FPET results of Dow Ultra+ are presented in tables 14 through 16 for the neat, 75/25, and 50/50 dilutions respectively. A graph showing the BLDT results as a function of temperature is presented in figure 18. The graph shows that for the neat fluid, all the FPET are above the acceptance criteria; therefore, this dilution would be considered unacceptable at any temperature. For the 75/25, the FPET at 0° and -10°C are below the acceptance criteria; while at -20°C, they are above. Therefore, this dilution would be considered acceptable down to about -10°C. All the FPET tests for the 50/50 dilution, at 0°, -5°, and -10°C, are below the acceptance criteria, and therefore, this dilution would be considered acceptable down to -10°C.

Figure 19 shows that the percentage elimination for all tests is above the 57% minimum requirement. Figure 20 shows that the relative humidity for all tests is in the required 70% ±30 range for the tests to be considered valid.

TABLE 14. AERODYNAMIC PERFORMANCE FOR DOW ULTRA+, NEAT

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o(1) µm	t_{end}(2) µm	F.E.(3) %	W.C.(4) %	V(5) m/s	δ* mm
E-629	FP-986	0.5	1.2	82.2	2000	457	77.1	0.75	35.0	12.45
E-629	FP-985	0.2	1.0	81.2	2000	356	82.2	1.05	36.7	11.79
E-629	FP-987	-2.1	-0.8	82.6	1975	424	78.5	1.20	35.6	12.76
E-629	FP-013	-10.7	-8.9	65.8	2000	577	71.2	-	35.9	13.03
E-629	FP-015	-10.6	-9.9	73.4	2000	526	73.7	0.90	34.8	13.49
E-629	FP-014	-11.8	-10.5	66.5	2000	541	72.9	1.20	35.0	13.62
E-629	FP-046	-18.6	-18.3	62.0	1975	668	66.2	1.05	34.7	13.38
E-629	FP-045	-20.1	-18.6	57.1	1975	668	66.2	1.05	34.2	13.21
E-629	FP-050	-20.6	-19.6	69.4	1975	704	64.4	0.30	34.5	13.36

(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.

Acceptance Criteria for Type II Fluid Series: D20 = 11.05 mm

TABLE 15. AERODYNAMIC PERFORMANCE FOR DOW ULTRA+, 75/25 DILUTION

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o (1) µm	t_{end} (2) µm	F.E. (3) %	W.C. (4) %	V (5) m/s	δ* mm
E-630	FP-990	0.0	0.2	86.6	2000	490	75.5	0.77	37.9	8.84
E-630	FP-989	-0.6	-0.1	86.0	2000	424	78.8	0.39	37.6	8.89
E-630	FP-988	-1.2	-0.4	84.8	2000	475	76.3	0.58	37.8	9.26
E-630	FP-017	-10.2	-10.1	70.2	2000	508	74.6	-0.19	36.4	10.08
E-630	FP-016	-11.5	-10.2	63.0	2000	559	72.1	-0.77	37.5	9.82
E-630	FP-018	-11.8	-10.7	61.0	2000	526	73.7	-0.19	35.6	10.63
E-630	FP-049	-21.6	-18.8	52.8	1975	660	66.6	0.19	34.3	12.20
E-630	FP-048	-20.6	-18.9	61.2	1975	719	63.6	0.58	34.9	12.11
E-630	FP-047	-22.5	-19.6	55.9	1975	668	65.2	0.00	35.4	12.07

(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.

Acceptance Criteria for Type IV Fluid Series: D20 = 11.05 mm

TABLE 16. AERODYNAMIC PERFORMANCE FOR DOW ULTRA+, 50/50 DILUTION

Fluid Code	Test Code	T_a °C	T_f °C	r.h. %	t_o (1) µm	t_{end} (2) µm	F.E. (3) %	W.C. (4) %	V (5) m/s	δ* mm
E-631	FP-991	0.7	0.6	86.3	2000	297	85.1	0.00	37.8	6.90
E-631	FP-992	-0.2	0.3	84.6	2000	323	83.9	-0.58	36.7	7.36
E-631	FP-993	0.3	0.3	83.6	2000	287	85.6	0.29	36.4	7.27
E-631	FP-021	-9.4	-8.6	72.7	2000	373	81.3	0.87	36.2	8.30
E-631	FP-020	-10.6	-9.3	64.8	1975	399	79.8	-0.58	35.8	8.58
E-631	FP-019	-10.6	-9.6	65.6	2000	363	81.8	0.29	36.1	8.65
E-631	FP-030	-15.7	-13.5	67.0	2000	406	79.7	0.29	36.1	8.56
E-631	FP-031	-16.4	-13.5	63.7	2000	389	80.6	0.87	36.7	8.70
E-631	FP-029	-17.0	-14.5	64.3	1975	406	79.4	-0.58	35.7	8.96

(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.

Acceptance Criteria for Type IV Fluid Series: D20 = 11.05 mm

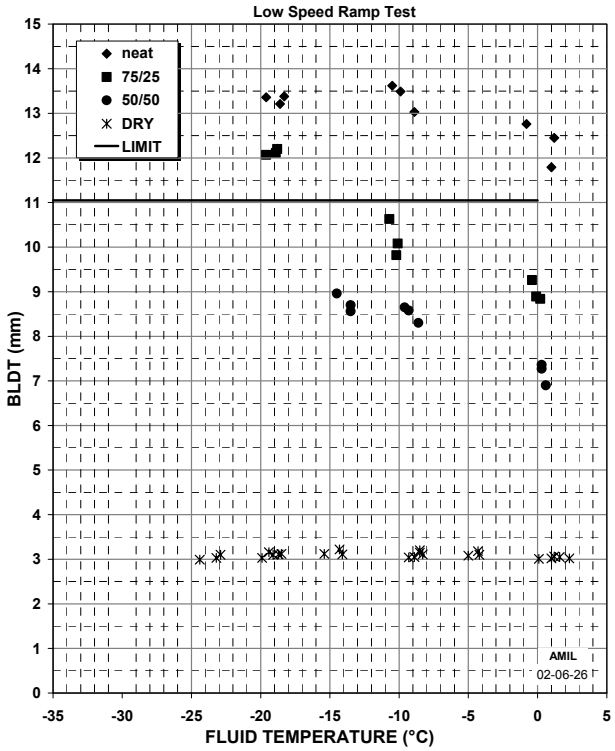


FIGURE 18. LOW-SPEED RAMP AERODYNAMIC TEST RESULTS FOR DOW ULTRA+

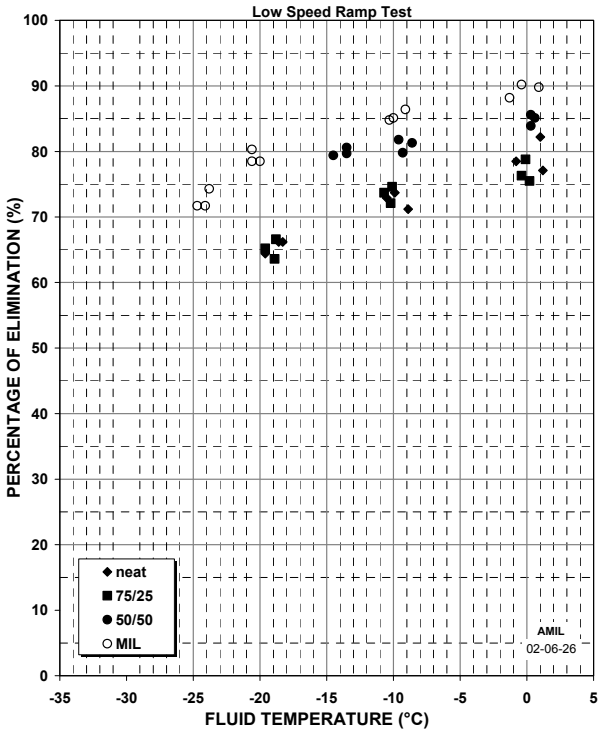


FIGURE 19. FLUID ELIMINATION FOR DOW ULTRA+

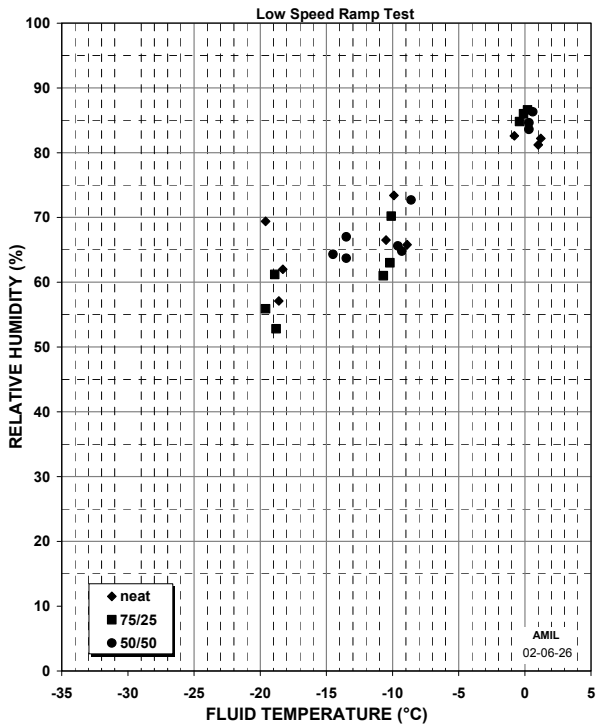


FIGURE 20. RELATIVE HUMIDITY FOR DOW ULTRA+

4. DISCUSSION.

"A de/anti-icing fluid is considered acceptable at a test temperature if none of the independent BLDT measurements is greater than the acceptance criteria" [1]. A summary of the temperature ranges in which the test fluids and their dilutions are considered acceptable for the low-speed ramp is presented in figure 21. A point represents the temperature at which the fluid is considered acceptable, and a line represents the interval along which the fluid is considered acceptable.

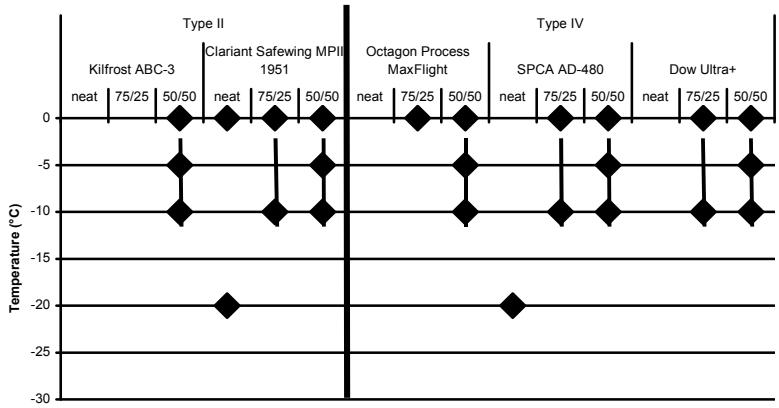


FIGURE 21. LOW-SPEED RAMP AERODYNAMIC ACCEPTANCE SUMMARY

The graph shows that all the 50/50 dilutions are acceptable for the low-speed ramp down to about -10°C, the lowest temperature tested due to freeze-point restrictions.

For the 75/25 dilutions, Clariant Safewing MPII 1951, SPCA AD-480, and Dow Ultra+ are acceptable for the low-speed ramp down to -10°C; at -15° or -20°C none of the fluids are aerodynamically acceptable. Octagon Process' MaxFlight's 75/25 dilution is only acceptable at 0°C, and the 75/25 dilution of Kilfrost ABC-3 did not meet low-speed ramp aerodynamic performance at any temperature.

For all the fluids tested, the only neat fluid whose FPET met the acceptance criteria for the low-speed ramp was Clariant Safewing MPII 1951 and only at 0° and -20°C. The tests for this fluid at -10°C were above the acceptance criteria. Therefore, this fluid would only be acceptable for the low-speed ramp at 0°C. SPCA AD-480's neat fluid met the FPET acceptance criteria at -20°C. However, according to the specification, this fluid dilution would not be considered aerodynamically acceptable at all temperatures since it does not pass at higher temperatures.

5. CONCLUSIONS.

The low-speed ramp testing, conducted according to Annex C of AMS1428, showed that all the 50/50 dilutions were acceptable for the low-speed ramp down to -10°C, the lowest temperature tested due to freeze-point restrictions. Three of the five 75/25 dilutions were acceptable for the low-speed ramp down to -10°C, below this temperature none of the fluids were acceptable. For the two other fluids, one was acceptable only at 0°C, the other was not acceptable at any temperature. For the fluids in their neat form, only one fluid was acceptable at 0°C. All other fluids neat FPETs were greater than the acceptance criteria.

6. RECOMMENDATIONS.

Based on the low-speed ramp tests conducted, it is recommended that

- Type II and IV fluids not be used on commuter type aircraft in their neat form without appropriate compensating measures being employed on the aircraft takeoff procedure;

- the dilutions can be used if they successfully meet the aerodynamic requirements of Annex C of AMS1428.

Further investigation recommended include a study to determine whether the acceleration profile used in Annex C of AMS1428 is representative of takeoff speed profiles of most commuter type aircraft.

7. REFERENCES.

1. Aerospace Material Specifications AMS1428D Fluid (February 2002), Aircraft Deicing/Anti-Icing, Non Newtonian (pseudo-plastic), SAE Types II, III and IV.

2. Louchez, P.R., Laforte, J.L., and Bouchard, G. (UQAC) "Boundary Layer Evaluation of Anti-icing Fluids for Commuter Aircraft," prepared for Transportation Development Centre, Policy and Coordination, Transport Canada, TP11811E, August 1994.

3. Laforte, J.L., Louchez, P., Bouchard, G., and Ma, F. (1990), "A Facility to Evaluate Performance of Aircraft De/Anti-Icing Fluids Subjected to Freezing Rain," Cold Regions Science and Technology 18, pp. 161-171.

APPENDIX A—BOUNDARY LAYER DISPLACEMENT THICKNESS 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 purposes, the following relation, obtained from application of Bernouilli and continuity equations according to usual wind tunnel practice, will be used:

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

where ρ is the mass per unit volume of the test gas at the test conditions, and S_1/S_2 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-sections 2 to 3.

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

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

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 equation 2 yields the value of the BLDT on a dry wall:

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

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 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 $\boldsymbol{\delta}^*_{ave}$ as a perimeter-weighted average of $\boldsymbol{\delta}^*_{dry}$ and δ^*, the following relation can be obtained:

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

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

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 setup 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:

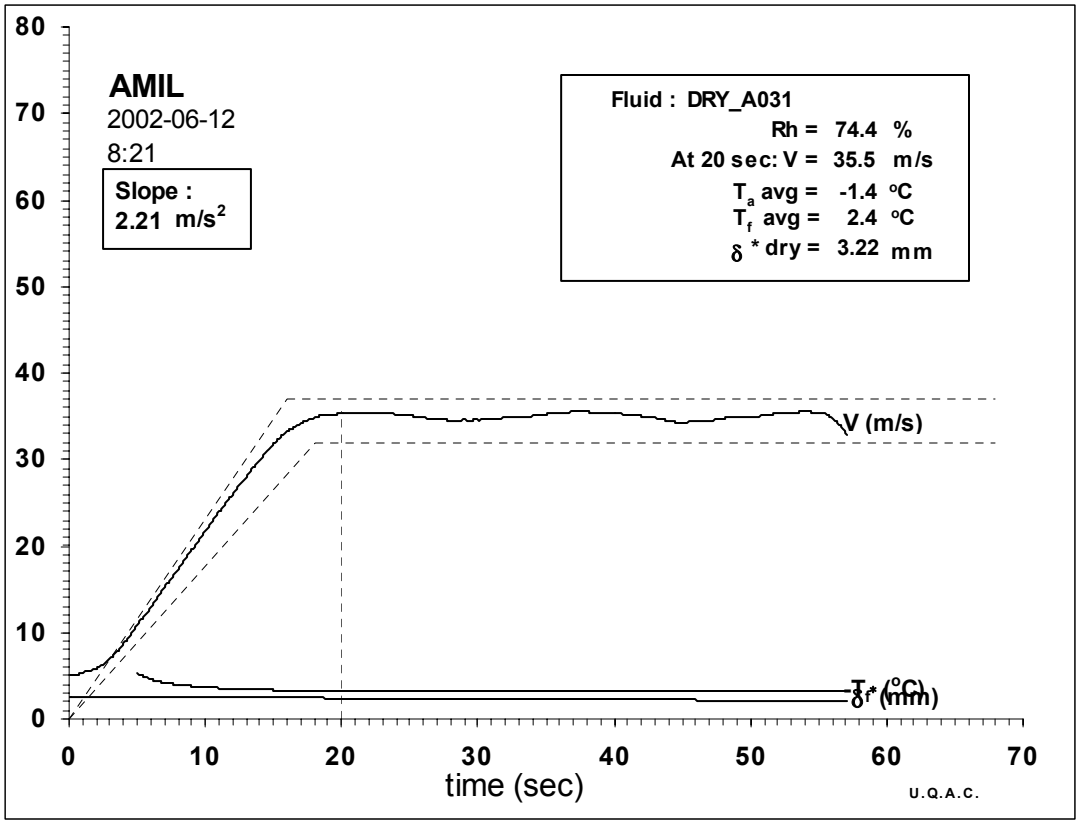
$$\delta^*_{dry} = const \times \left[\frac{V}{n}\right]^{-1/5} \tag{4}$$

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, equation 4 will be used to evaluate, as function of the instantaneous velocity determined by equation 1, the value of δ^*_{dry} to be used in equation 3.

APPENDIX B—TEST DATA SHEETS

B.1 DRY RUNS, TYPE II FLUID SERIES.

FPD-031



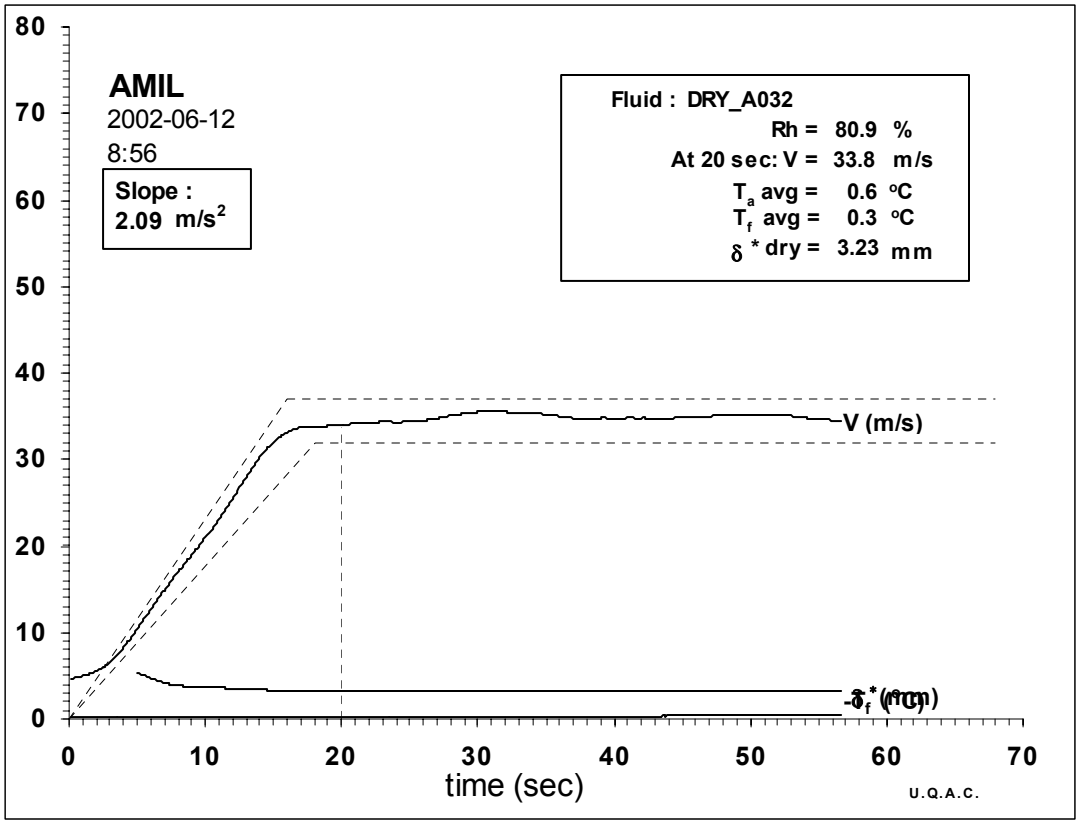
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-1.5	2.4	72.6	3.23	35.4	0.02	3.18
20	-1.5	2.4	75.6	3.23	35.4	0.03	3.26
21	-1.5	2.4	74.0	3.30	35.8	0.03	3.21

Averages:

20	-1.5	**2.4**	74.4	3.25	35.5	0.03	**3.22**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



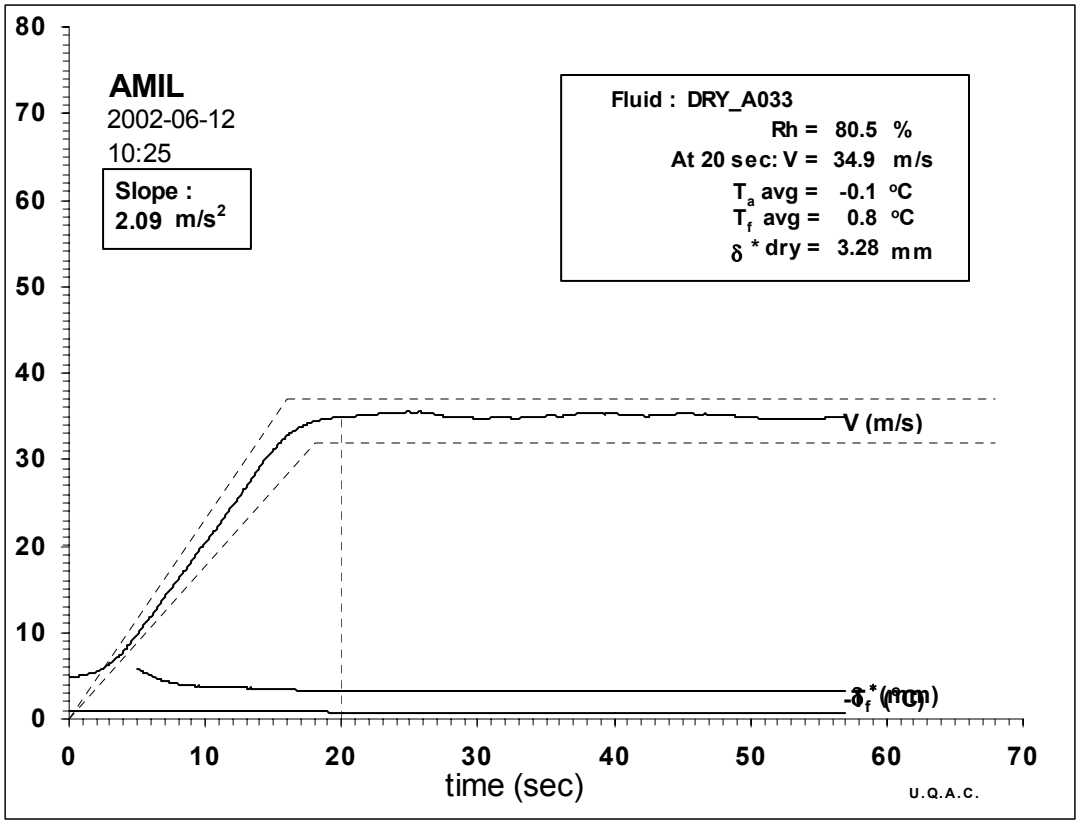
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	0.6	0.2	81.2	2.90	33.7	0.03	3.23
20	0.6	0.2	80.9	2.93	33.9	0.03	3.23
21	0.5	0.2	80.5	2.92	33.8	0.03	3.23

Averages:

20	0.6	**0.2**	80.9	2.92	33.8	0.03	**3.23**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	0.8	78.7	3.15	35.1	0.03	3.25
20	-0.4	0.8	80.9	3.10	34.8	0.04	3.29
21	-0.4	0.8	81.6	3.13	34.9	0.04	3.29

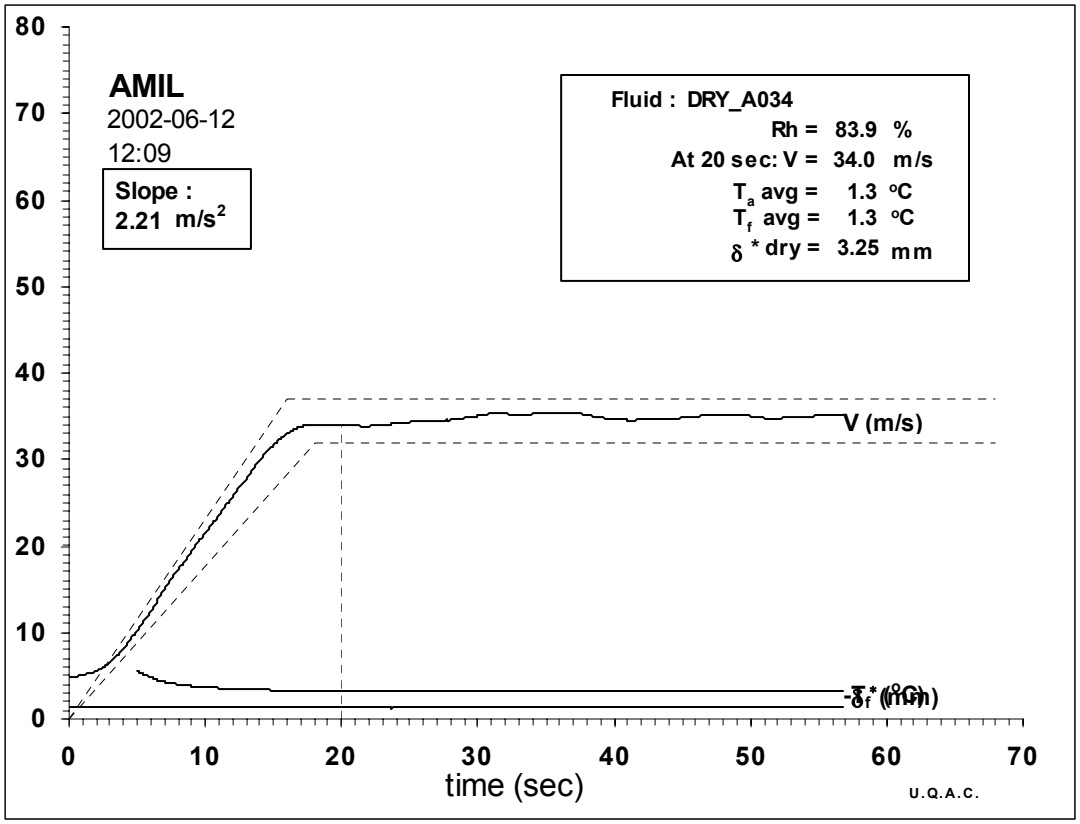
Averages:

20	-0.4	**0.8**	80.5	3.12	34.9	0.04	**3.28**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

FPD-034



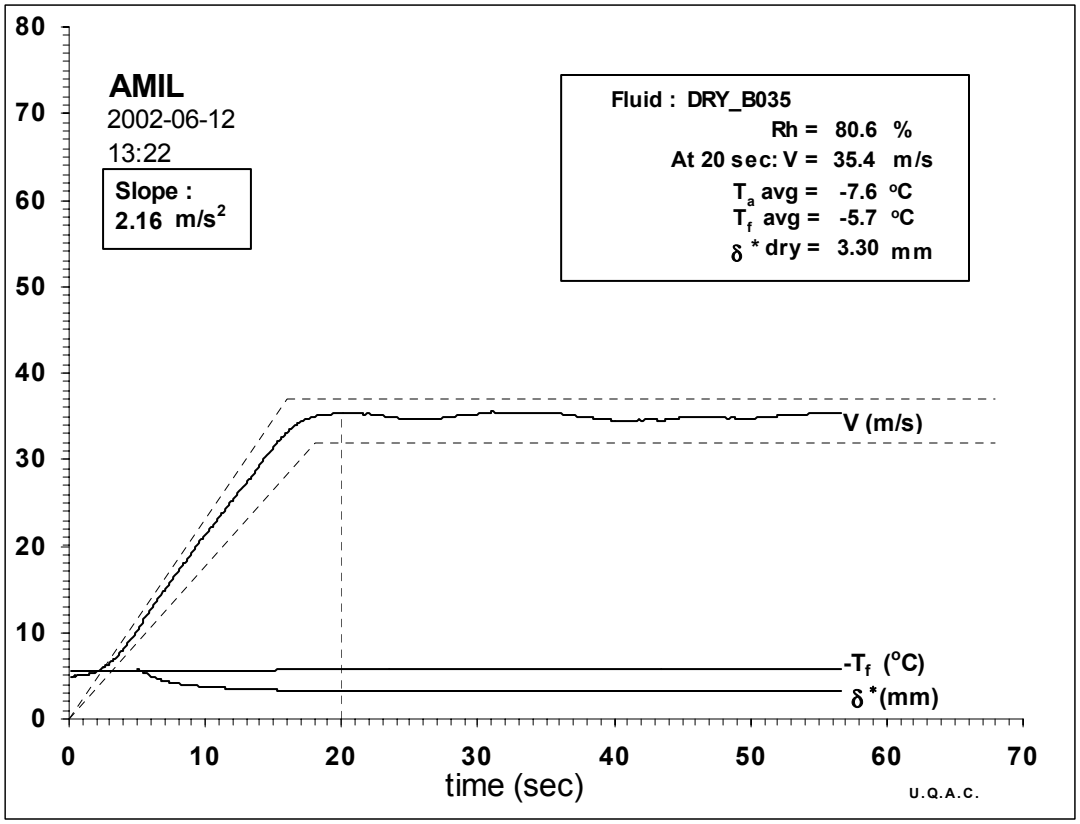
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	1.2	1.3	83.9	2.97	34.1	0.03	3.24
20	1.2	1.3	83.9	2.93	33.9	0.03	3.23
21	1.2	1.3	83.9	2.98	34.2	0.04	3.30

Averages:

20	1.2	**1.3**	83.9	2.95	34.0	0.03	**3.25**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



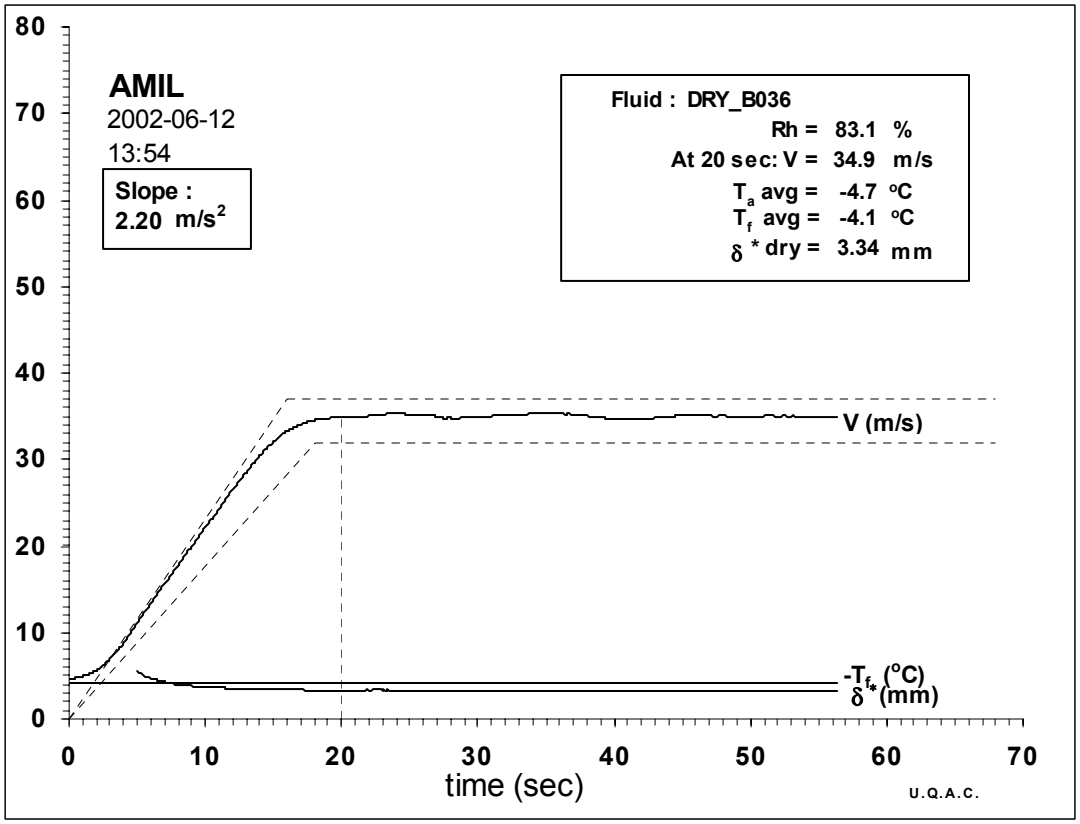
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-7.7	-5.7	82.5	3.28	35.3	0.05	3.33
20	-7.7	-5.7	78.7	3.28	35.3	0.04	3.30
21	-7.7	-5.7	82.3	3.33	35.6	0.04	3.26

Averages:

20	-7.7	**-5.7**	80.6	3.30	35.4	0.04	**3.30**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



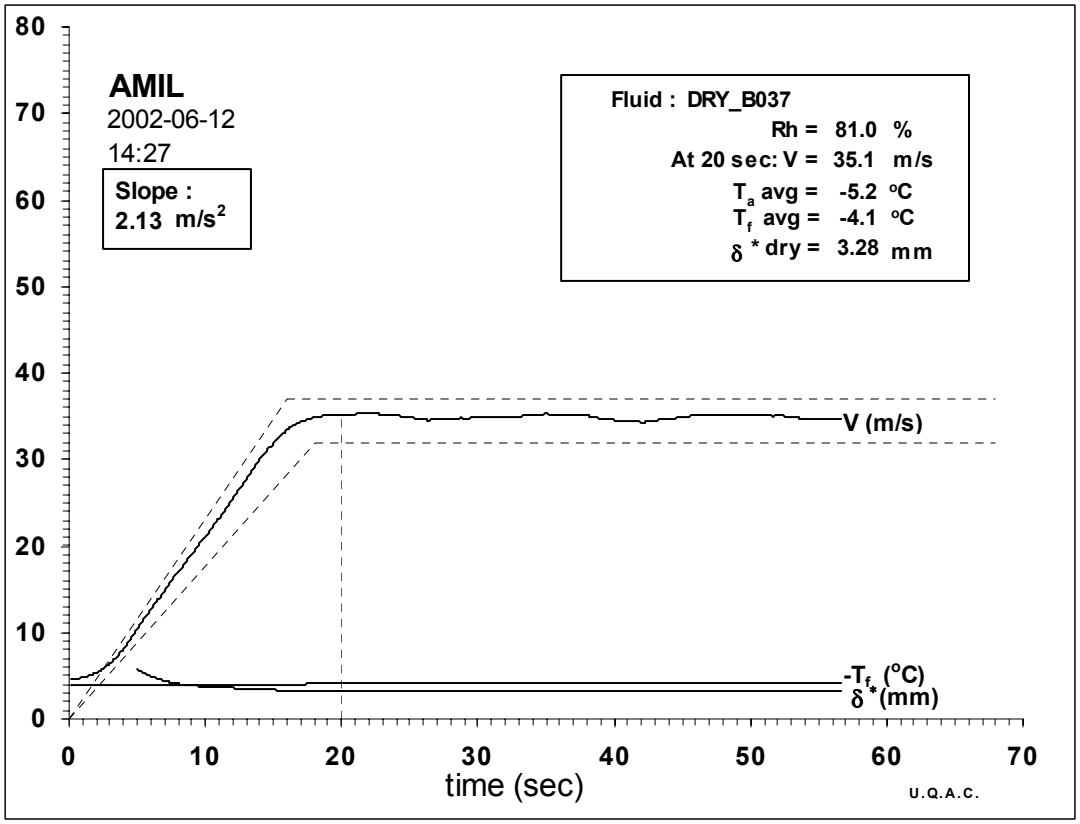
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-4.8	-4.1	86.9	3.18	34.9	0.05	3.33
20	-4.8	-4.1	81.1	3.20	35.0	0.05	3.33
21	-4.8	-4.1	83.3	3.13	34.7	0.05	3.35

Averages:

20	-4.8	**-4.1**	83.1	3.18	34.9	0.05	**3.34**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



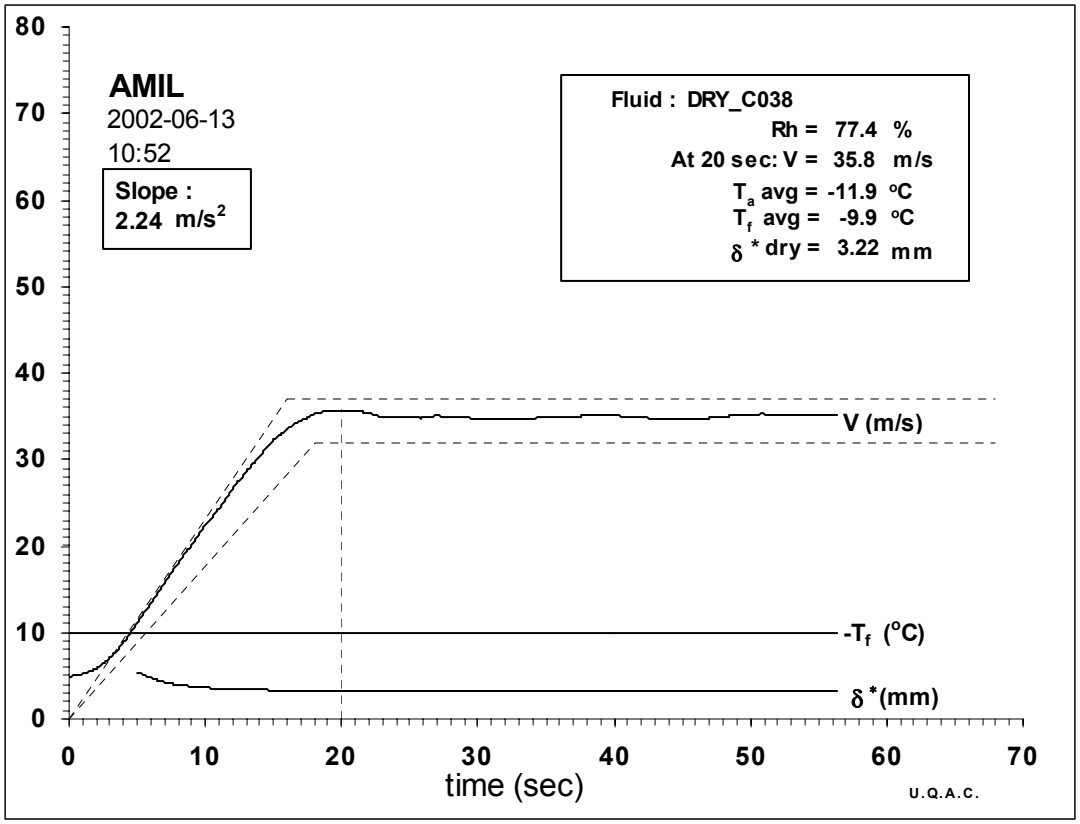
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-5.3	-4.1	84.8	3.15	34.7	0.04	3.28
20	-5.3	-4.1	81.3	3.23	35.2	0.03	3.26
21	-5.3	-4.1	77.3	3.26	35.3	0.04	3.31

Averages:

20	-5.3	**-4.1**	81.0	3.22	35.1	0.04	**3.28**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



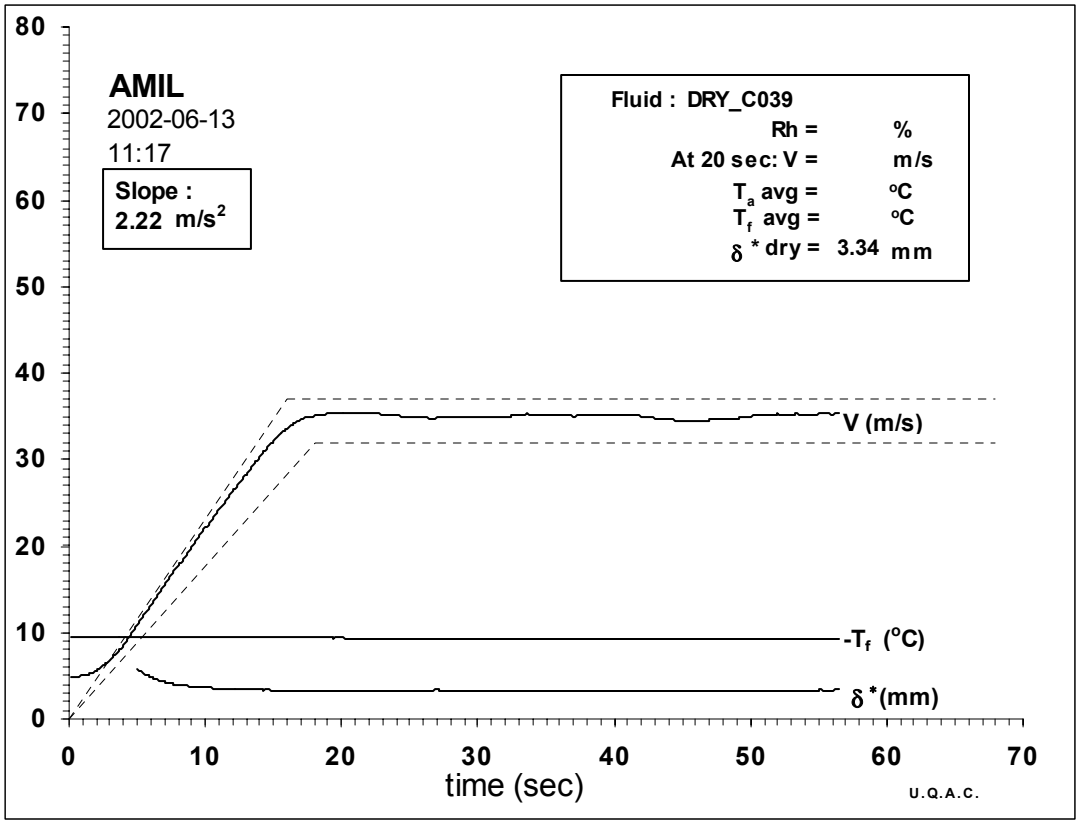
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-12.0	-9.9	76.2	3.38	35.5	0.03	3.24
20	-11.9	-9.9	78.8	3.48	36.0	0.03	3.24
21	-12.0	-9.9	76.2	3.42	35.7	0.02	3.19

Averages:

20	-12.0	**-9.9**	77.4	3.44	35.8	0.03	**3.22**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



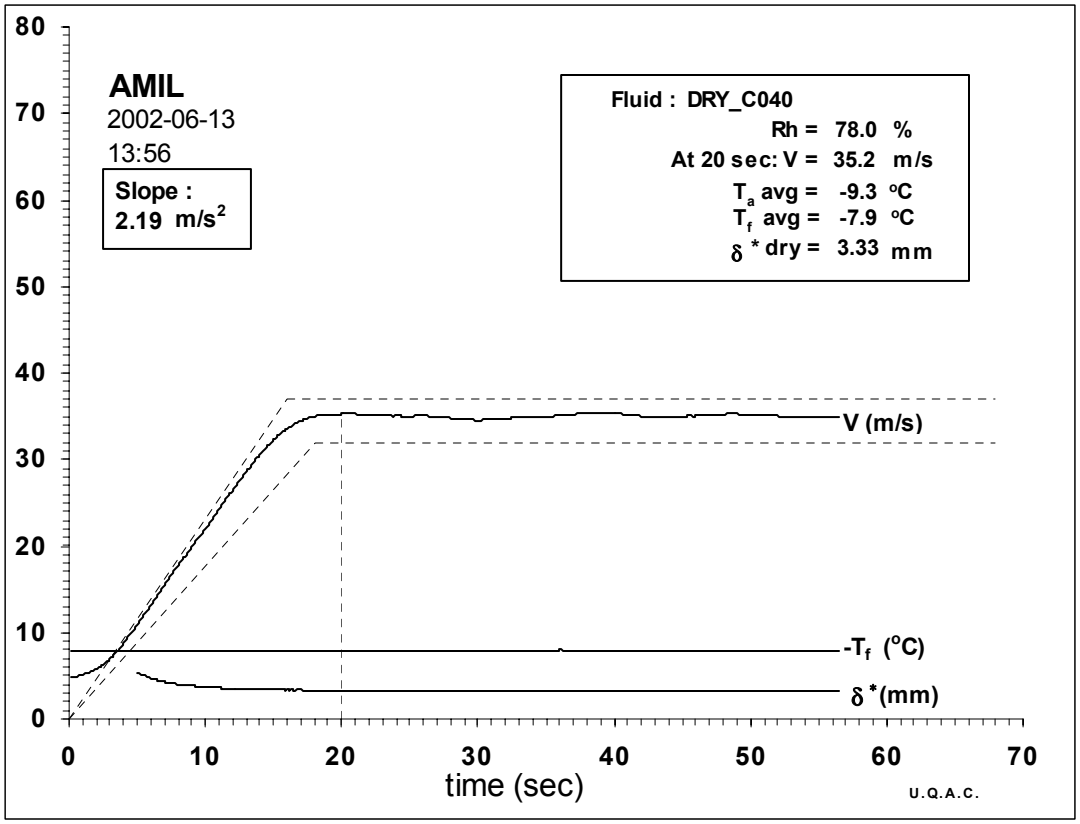
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-9.8	-9.4	84.3	3.27	35.1	0.05	3.37
20	-9.8	-9.4	75.7	3.33	35.4	0.05	3.34
21	-9.8	-9.4	81.5	3.32	35.4	0.05	3.32

Averages:

20	-9.8	**-9.4**	79.4	3.31	35.3	0.05	**3.34**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



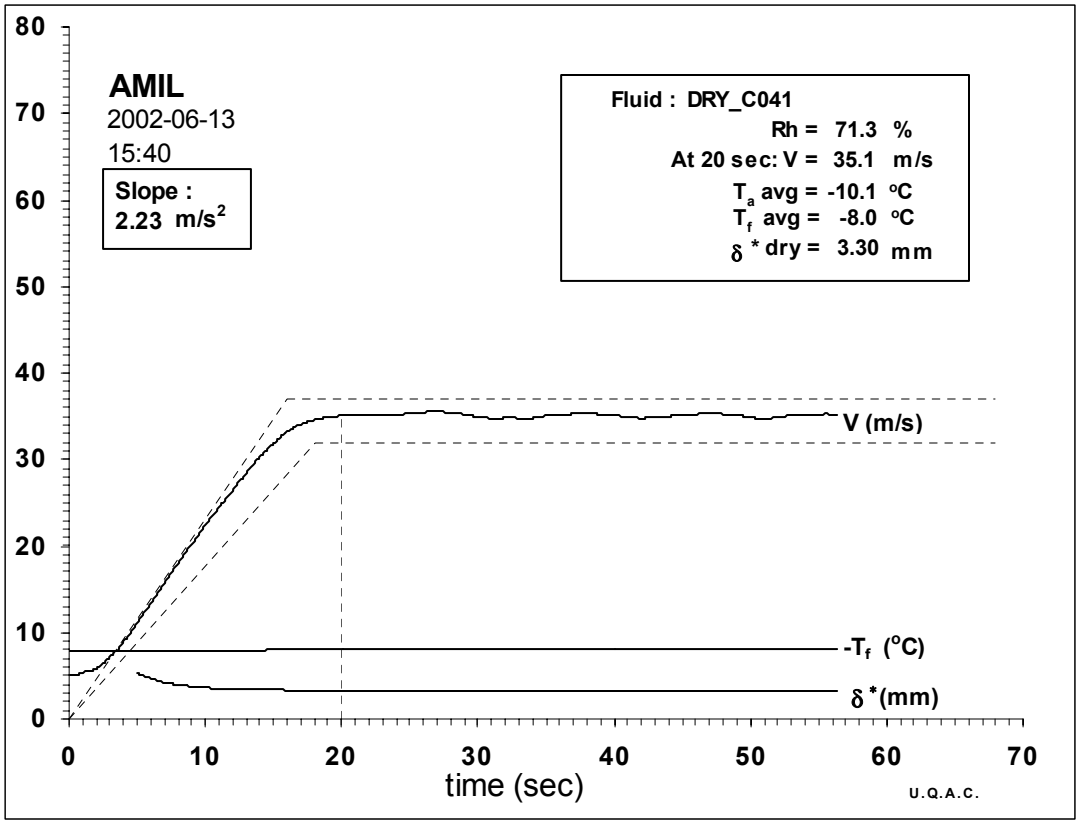
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-9.4	-8.0	80.8	3.33	35.4	0.03	3.26
20	-9.4	-8.0	76.6	3.27	35.1	0.05	3.34
21	-9.4	-7.9	77.7	3.28	35.1	0.05	3.37

Averages:

20	-9.4	**-7.9**	78.0	3.29	35.2	0.05	**3.33**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-10.1	-8.0	71.2	3.26	35.0	0.03	3.26
20	-10.1	-8.0	70.7	3.28	35.1	0.04	3.29
21	-10.1	-8.0	72.4	3.28	35.1	0.05	3.35

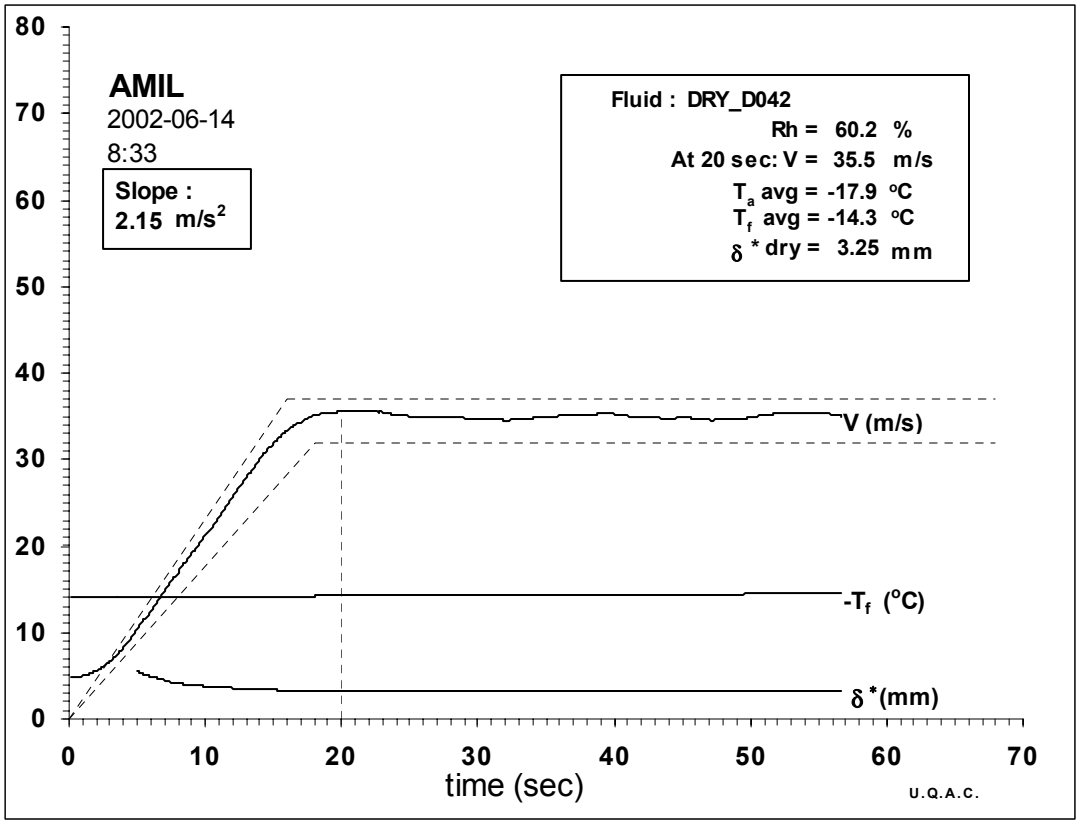
Averages:

20	-10.1	**-8.0**	71.3	3.28	35.1	0.04	**3.30**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

FPD-042



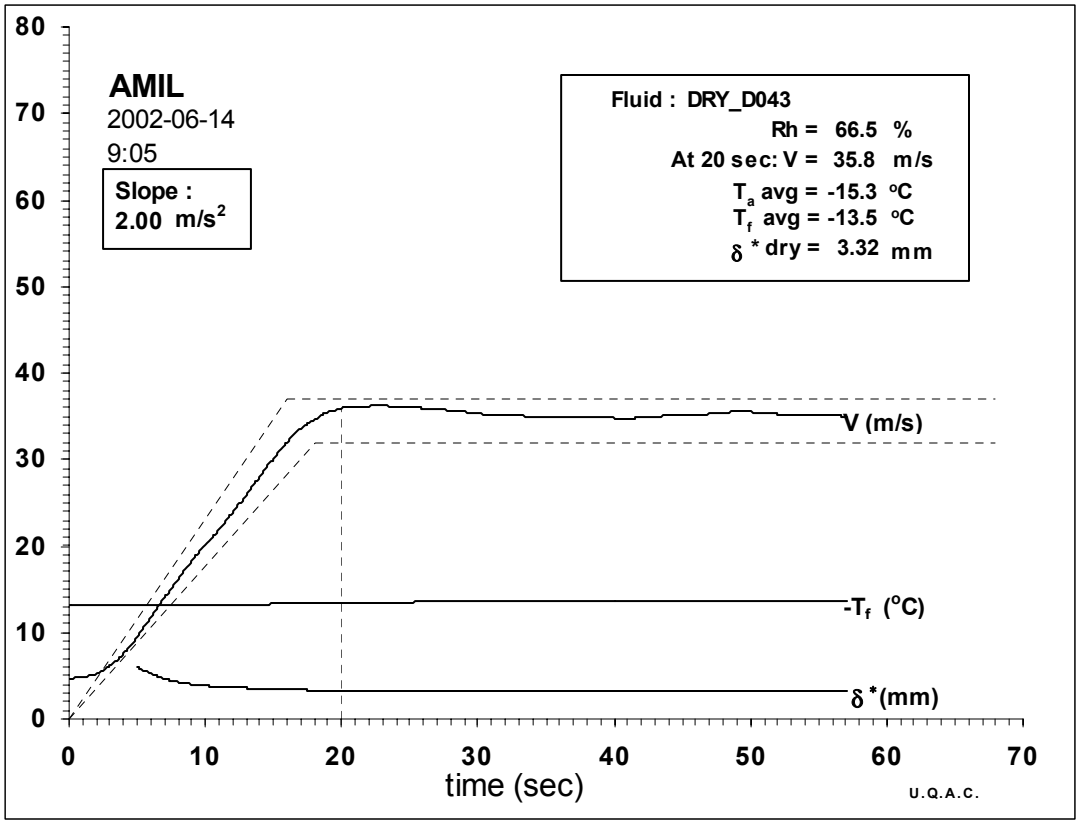
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-18.1	-14.2	59.8	3.45	35.5	0.05	3.35
20	-18.1	-14.2	60.3	3.49	35.7	0.02	3.20
21	-18.1	-14.3	60.5	3.43	35.4	0.04	3.27

Averages:

20	-18.1	**-14.2**	60.2	3.46	35.5	0.04	**3.25**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



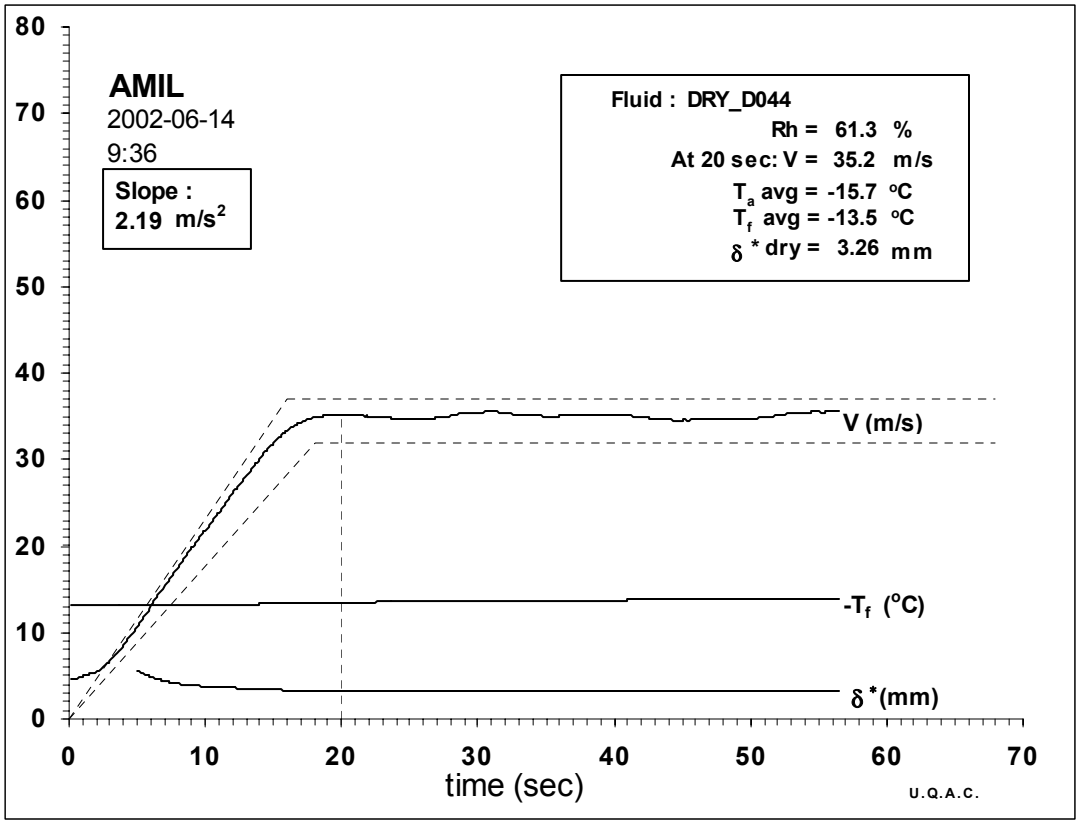
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-15.4	-13.4	70.5	3.47	35.8	0.06	3.38
20	-15.5	-13.4	65.1	3.44	35.6	0.04	3.30
21	-15.5	-13.4	65.5	3.55	36.1	0.04	3.29

Averages:

20	-15.5	**-13.4**	66.5	3.48	35.8	0.05	**3.32**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



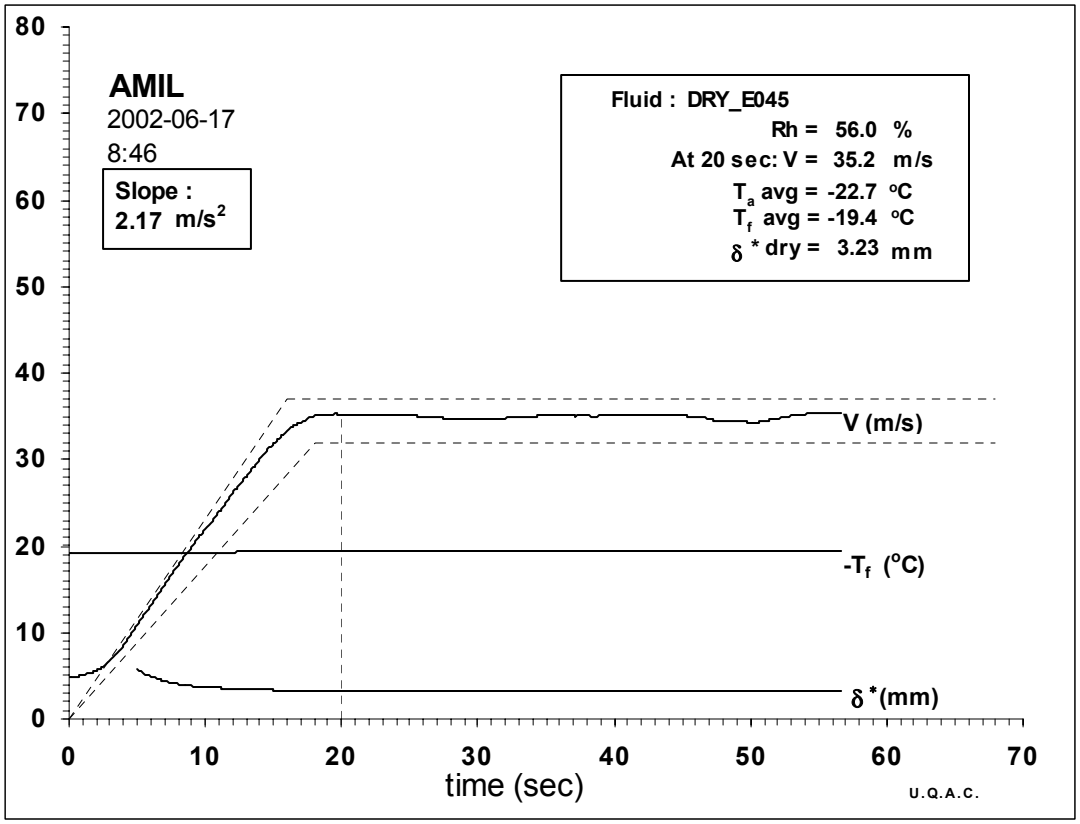
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-15.9	-13.4	61.1	3.39	35.3	0.04	3.27
20	-15.9	-13.5	61.7	3.37	35.2	0.03	3.25
21	-16.0	-13.5	60.8	3.37	35.2	0.04	3.26

Averages:

20	-15.9	**-13.5**	61.3	3.37	35.2	0.03	**3.26**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



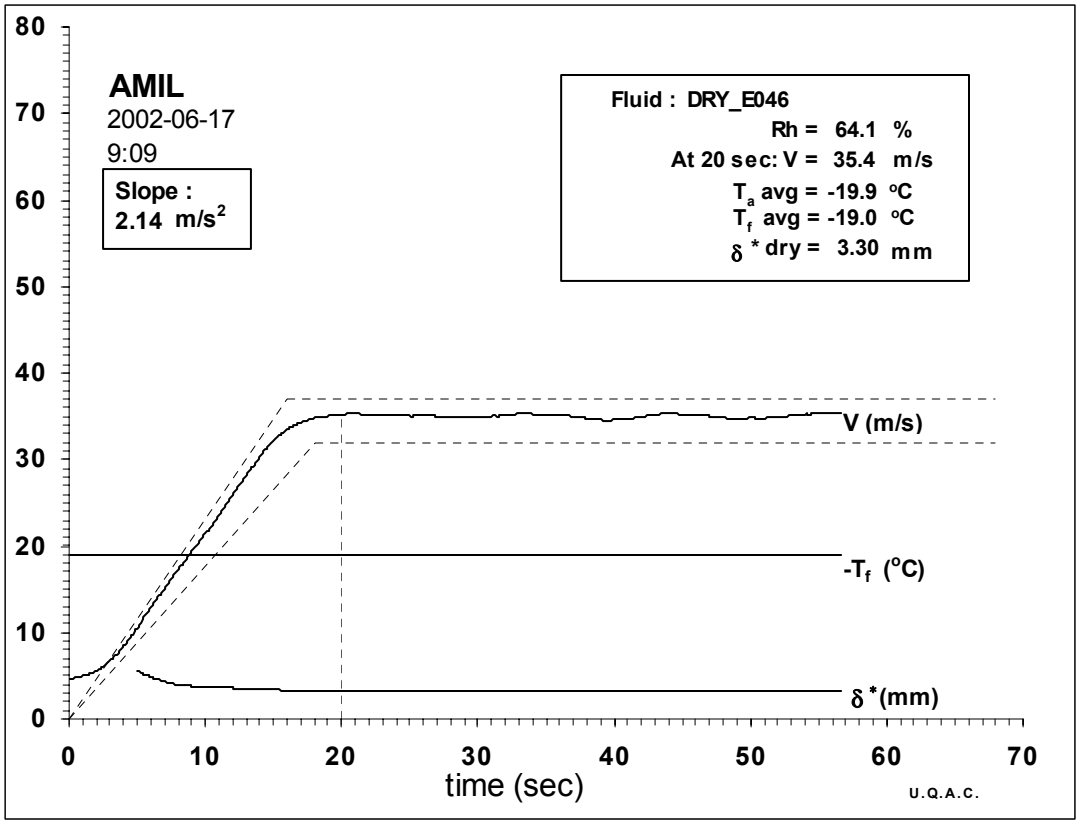
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-22.8	-19.4	57.8	3.49	35.4	0.03	3.22
20	-22.8	-19.4	55.4	3.48	35.3	0.03	3.22
21	-22.8	-19.4	55.7	3.41	34.9	0.03	3.24

Averages:

20	-22.8	**-19.4**	56.0	3.46	35.2	0.03	**3.23**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



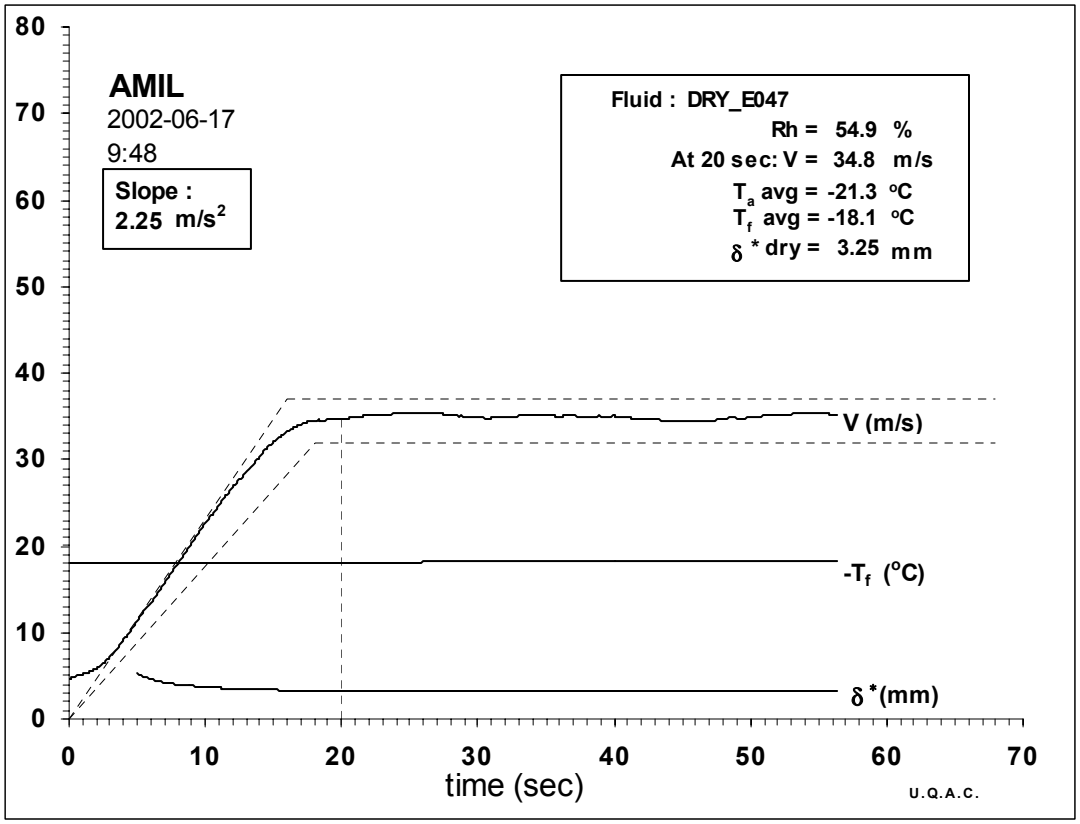
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-20.0	-19.0	64.7	3.40	35.1	0.03	3.25
20	-20.0	-19.0	64.0	3.47	35.4	0.05	3.31
21	-20.0	-19.0	63.7	3.48	35.5	0.05	3.31

Averages:

20	-20.0	**-19.0**	64.1	3.46	35.4	0.04	**3.30**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



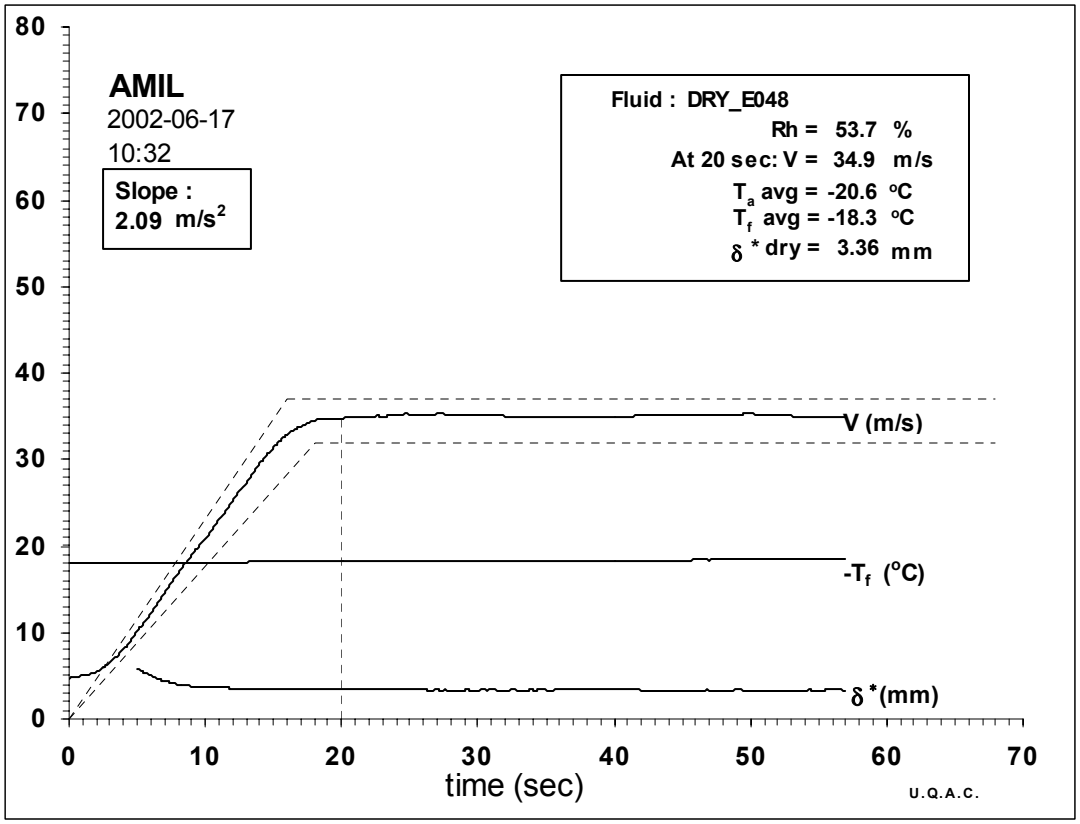
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-21.4	-18.1	55.8	3.29	34.4	0.04	3.28
20	-21.4	-18.1	53.9	3.40	35.0	0.03	3.23
21	-21.4	-18.1	55.6	3.34	34.6	0.03	3.24

Averages:

20	-21.4	**-18.1**	54.9	3.36	34.8	0.03	**3.25**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



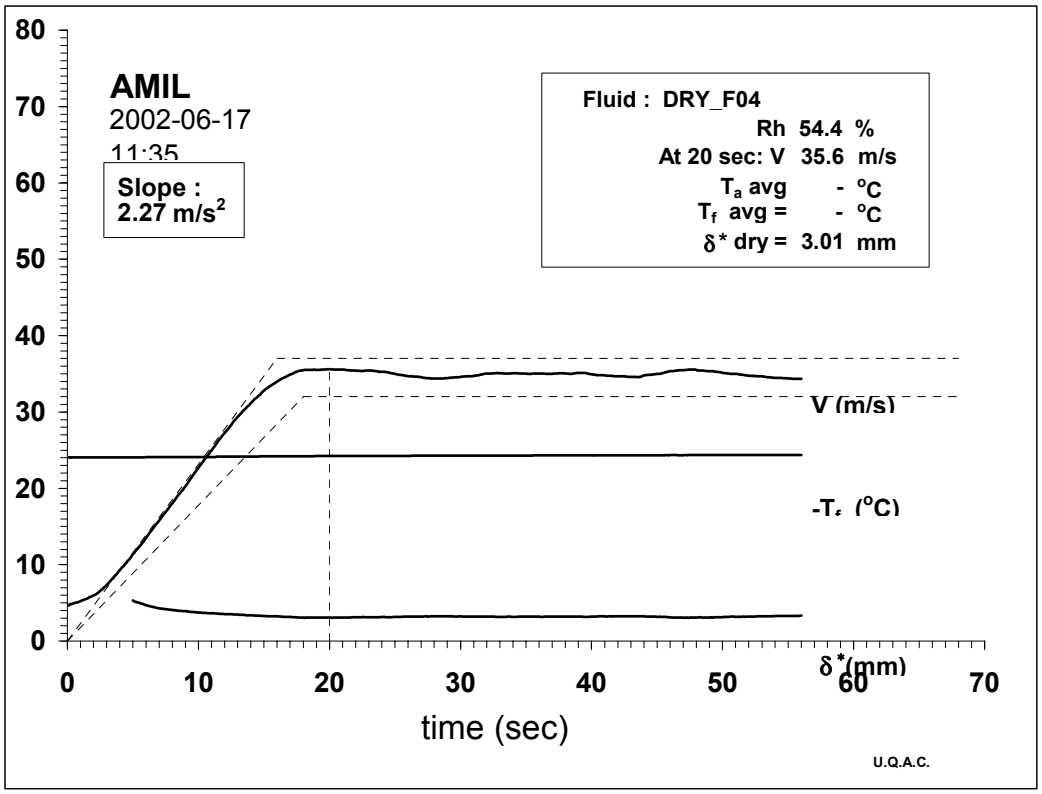
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-20.8	-18.2	50.9	3.39	35.0	0.05	3.34
20	-20.8	-18.2	54.3	3.36	34.8	0.06	3.38
21	-20.9	-18.2	54.9	3.37	34.9	0.05	3.35

Averages:

20	-20.8	**-18.2**	53.7	3.37	34.9	0.05	**3.36**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



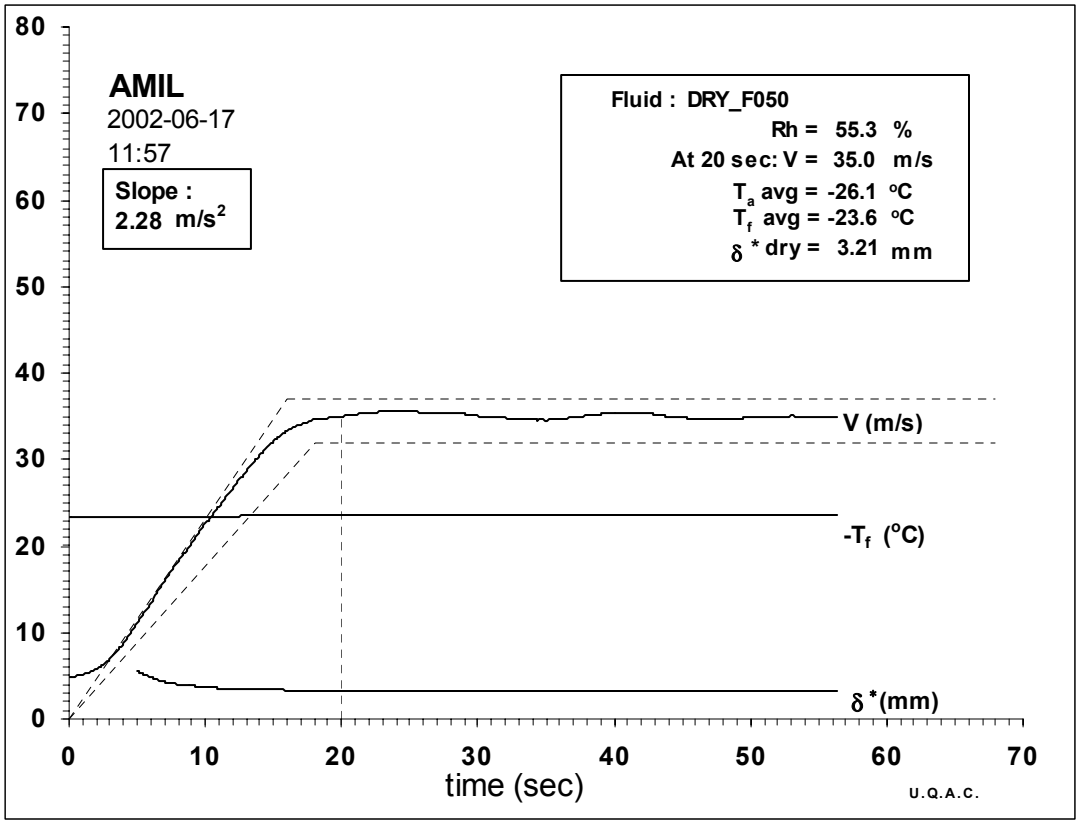
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-27.8	-24.2	53.4	3.76	36.3	-0.04	2.86
20	-27.8	-24.2	54.4	3.61	35.6	-0.01	3.00
21	-27.8	-24.2	55.3	3.50	35.0	0.02	3.15

Averages:

20	-27.8	**-24.2**	54.4	3.61	35.6	-0.01	**3.01**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



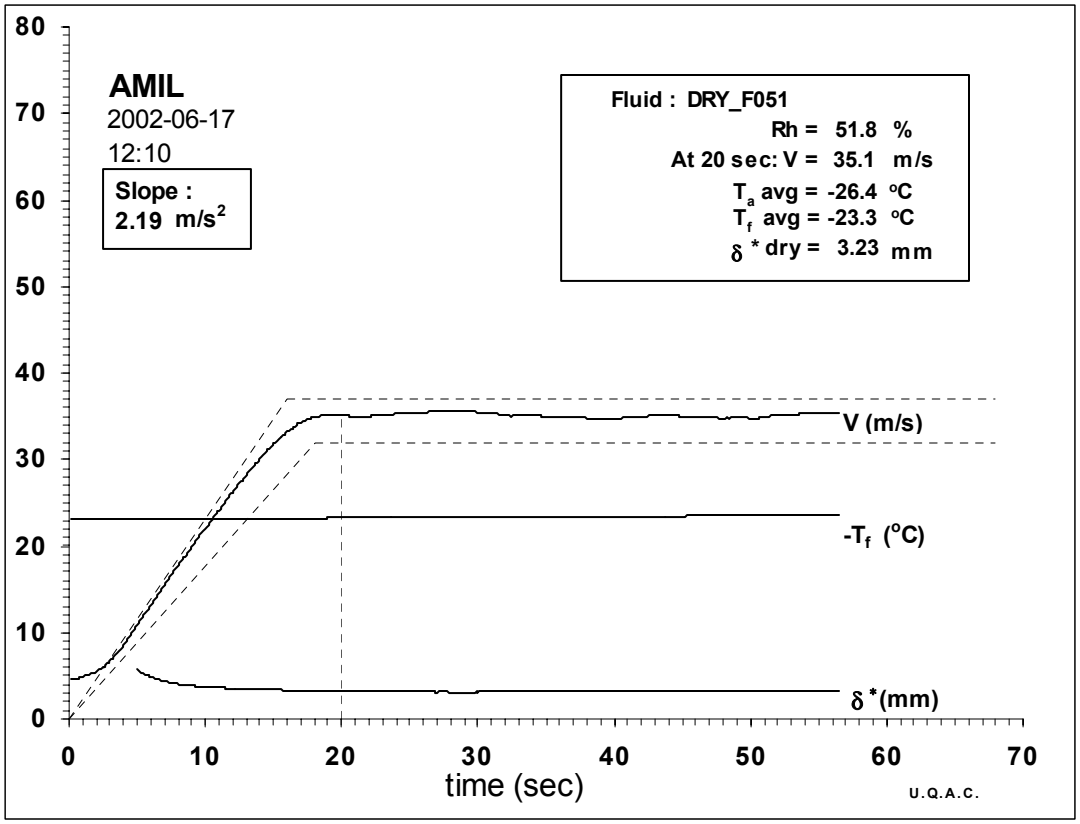
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-26.2	-23.5	55.1	3.45	34.9	0.05	3.32
20	-26.3	-23.6	55.8	3.54	35.3	0.01	3.12
21	-26.3	-23.5	54.9	3.40	34.6	0.04	3.28

Averages:

20	-26.3	**-23.5**	55.3	3.48	35.0	0.03	**3.21**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-26.7	-23.2	52.0	3.53	35.2	0.02	3.19
20	-26.6	-23.3	52.6	3.44	34.8	0.04	3.26
21	-26.7	-23.3	50.3	3.54	35.3	0.03	3.21

Averages:

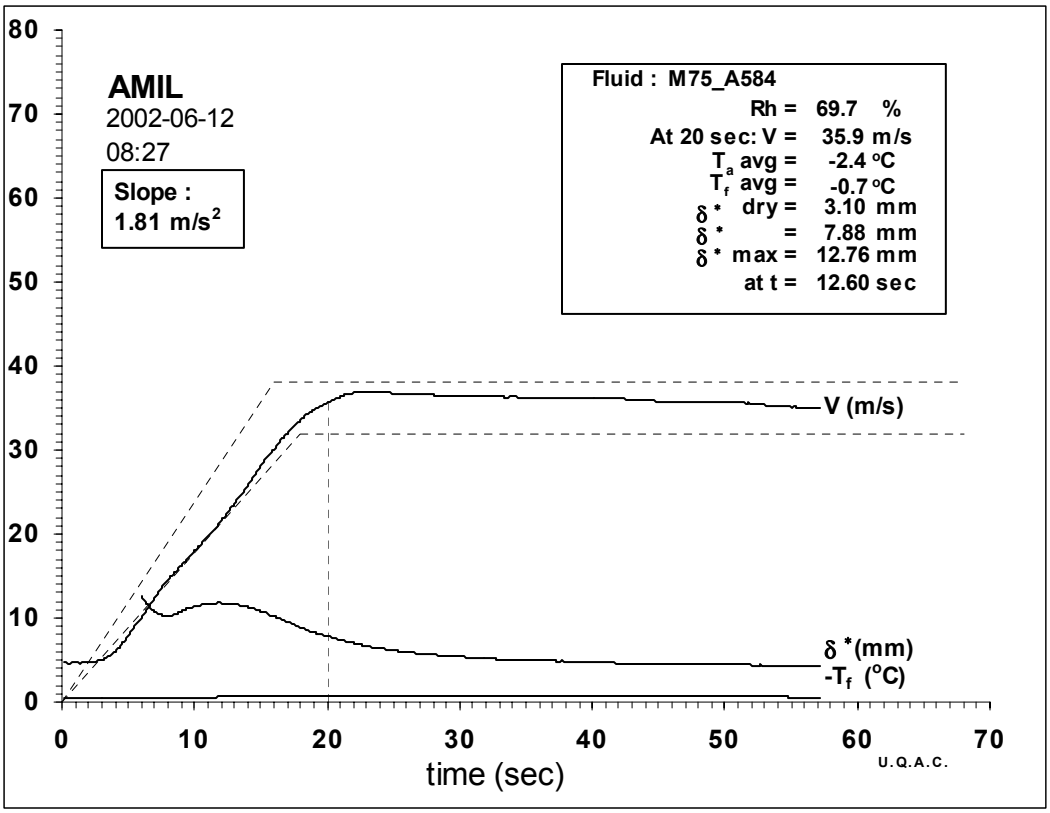
20	-26.6	**-23.3**	51.8	3.49	35.1	0.03	**3.23**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.2 RUNS WITH REFERENCE FLUID M-034, TYPE II FLUID SERIES.

FPC-584



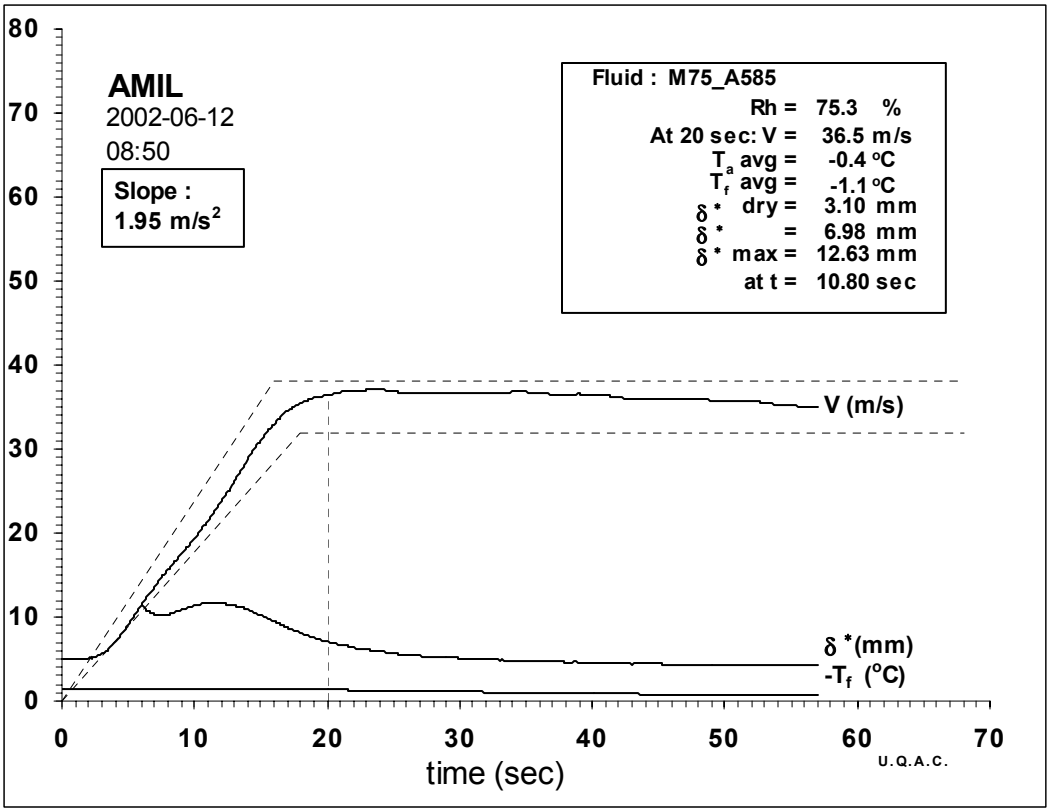
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-2.6	-0.7	72.1	3.16	34.9	0.36	8.30
20	-2.6	-0.7	68.4	3.40	36.2	0.35	7.89
21	-2.6	-0.7	69.7	3.38	36.1	0.32	7.50

Averages :

20	-2.6	**-0.7**	69.7	3.33	35.9	0.34	**7.88**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



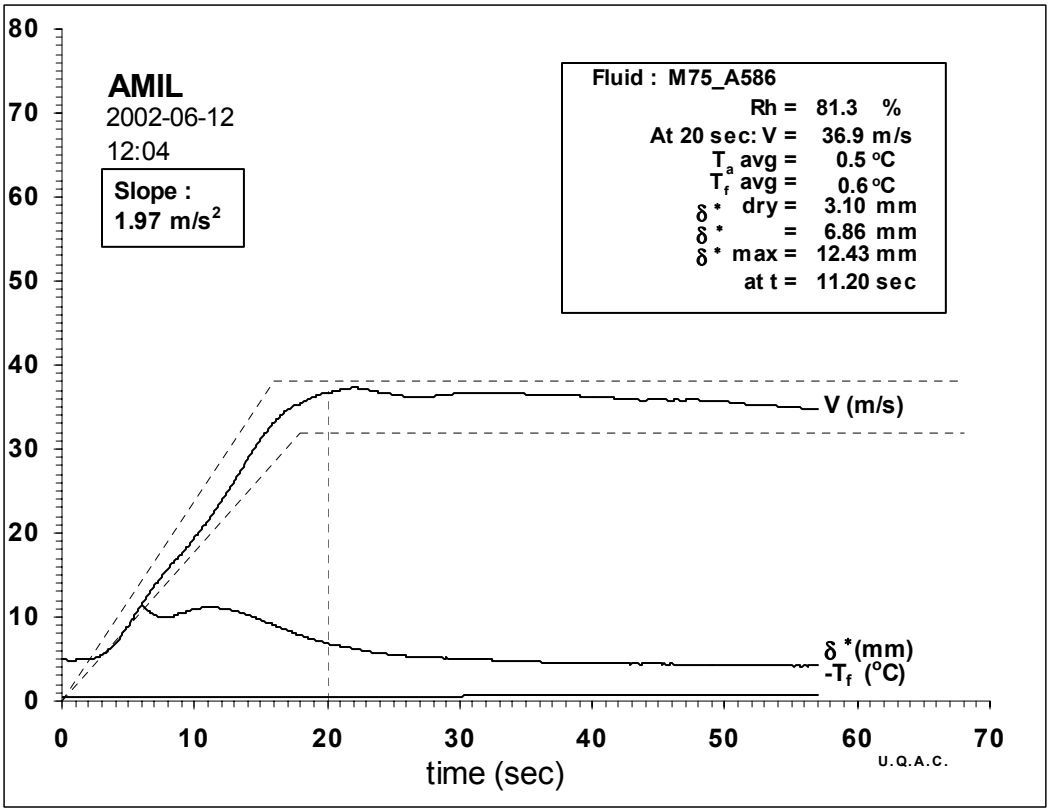
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.5	-1.3	74.9	3.37	36.3	0.32	7.44
20	-0.5	-1.3	75.3	3.51	37.0	0.30	7.12
21	-0.5	-1.3	75.7	3.32	36.0	0.23	6.37

Averages :

20	-0.5	**-1.3**	75.3	3.43	36.5	0.29	**6.98**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



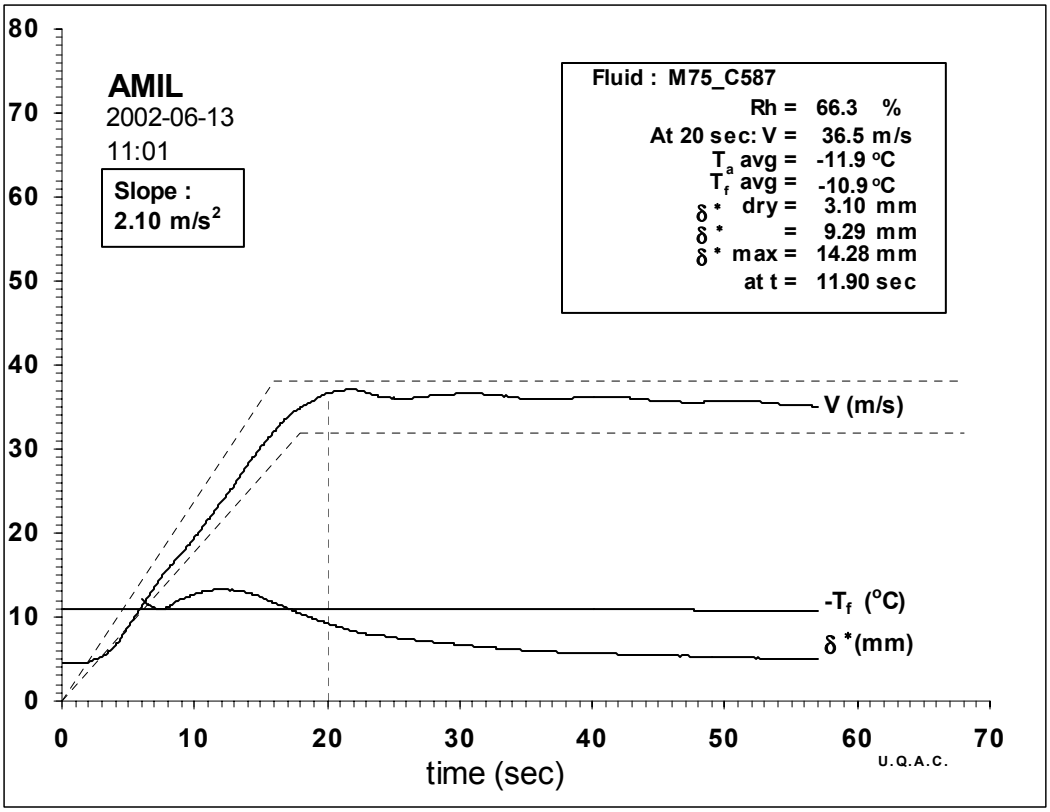
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.3	0.5	79.7	3.36	36.2	0.30	7.20
20	0.4	0.5	81.0	3.44	36.7	0.28	6.84
21	0.4	0.5	83.2	3.67	37.9	0.27	6.59

Averages :

20	0.4	**0.5**	81.3	3.48	36.9	0.28	**6.86**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



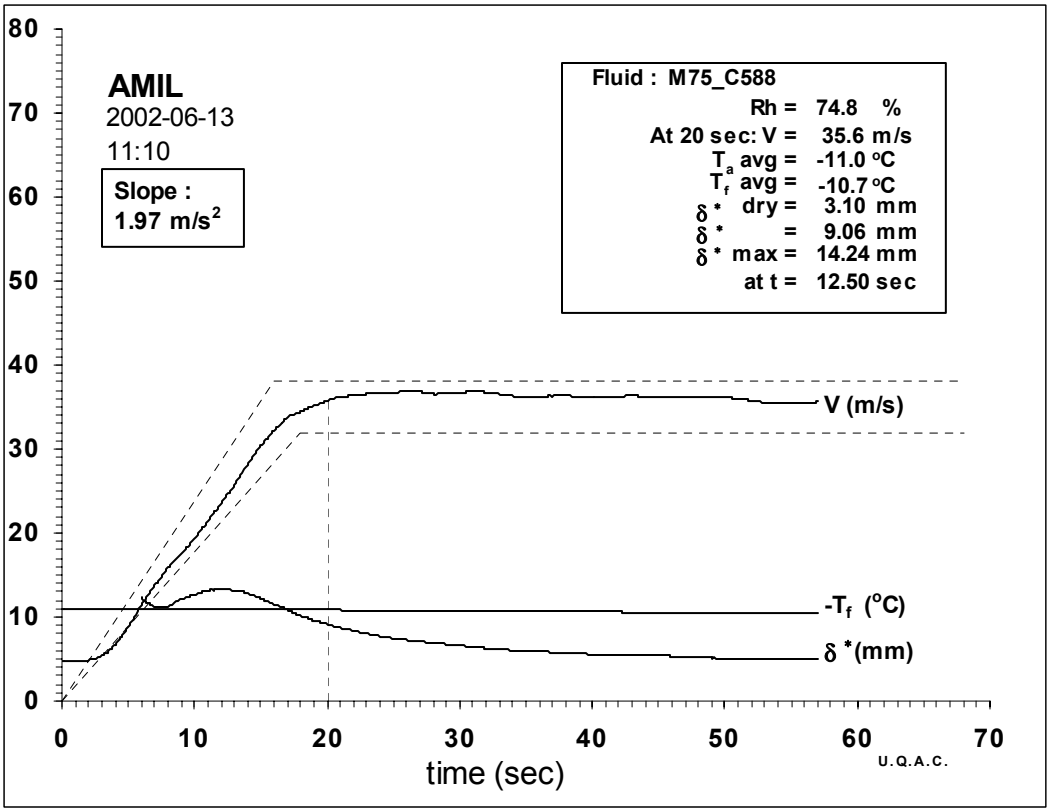
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-12.1	-11.0	67.7	3.48	36.0	0.51	9.75
20	-12.1	-11.0	64.8	3.54	36.3	0.48	9.21
21	-12.1	-11.0	67.8	3.69	37.1	0.48	9.06

Averages :

20	-12.1	**-11.0**	66.3	3.57	36.5	0.49	**9.29**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



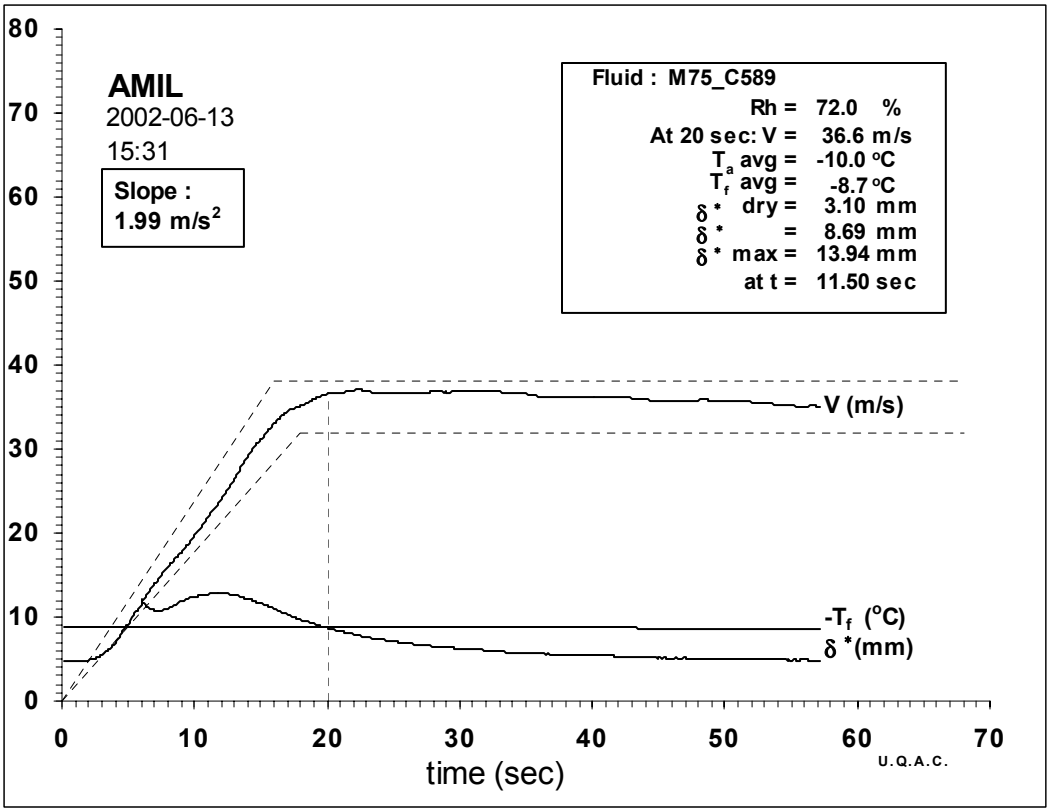
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-11.1	-10.9	73.2	3.31	35.2	0.44	9.15
20	-11.1	-10.8	73.8	3.37	35.5	0.45	9.18
21	-11.0	-10.9	77.7	3.50	36.2	0.44	8.80

Averages :

20	-11.1	**-10.8**	74.8	3.39	35.6	0.44	**9.06**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



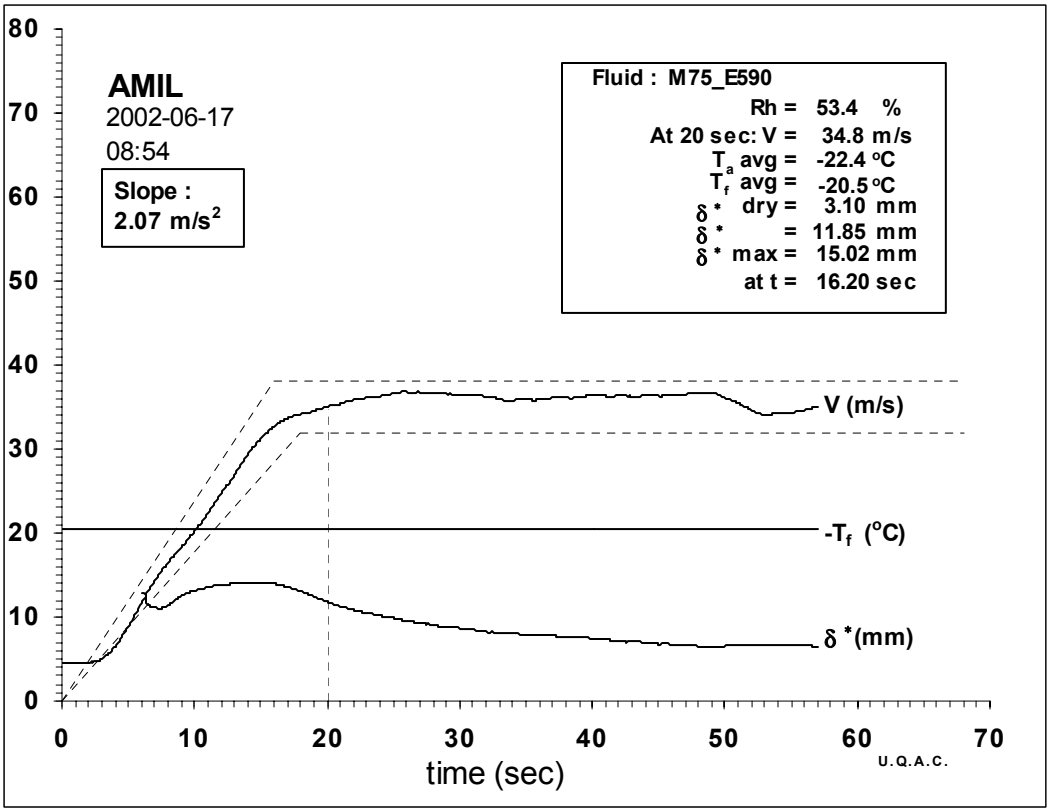
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.2	-8.8	70.5	3.47	36.1	0.43	8.82
20	-10.2	-8.7	69.6	3.50	36.3	0.43	8.76
21	-10.2	-8.7	77.3	3.77	37.7	0.44	8.47

Averages :

20	-10.2	**-8.7**	72.0	3.57	36.6	0.44	**8.69**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



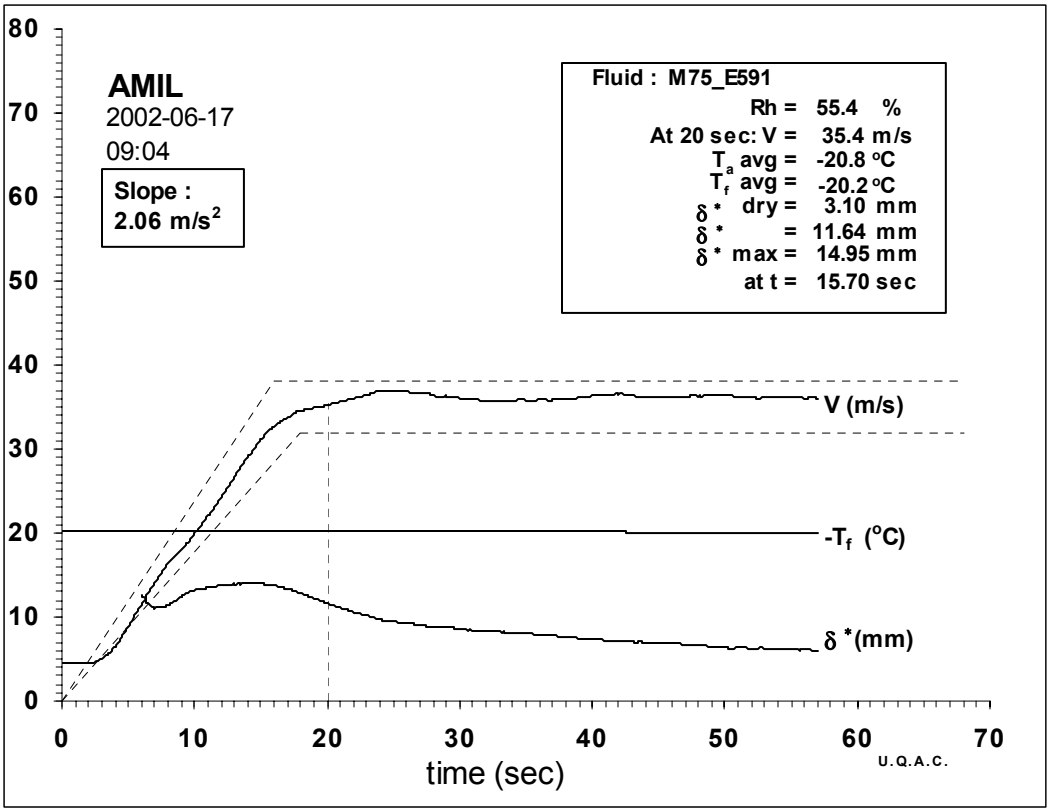
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-22.7	-20.5	55.7	3.28	34.2	0.68	12.06
20	-22.6	-20.5	52.3	3.38	34.8	0.68	11.94
21	-22.6	-20.5	53.3	3.52	35.5	0.67	11.51

Averages :

20	-22.6	**-20.5**	53.4	3.39	34.8	0.68	**11.85**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



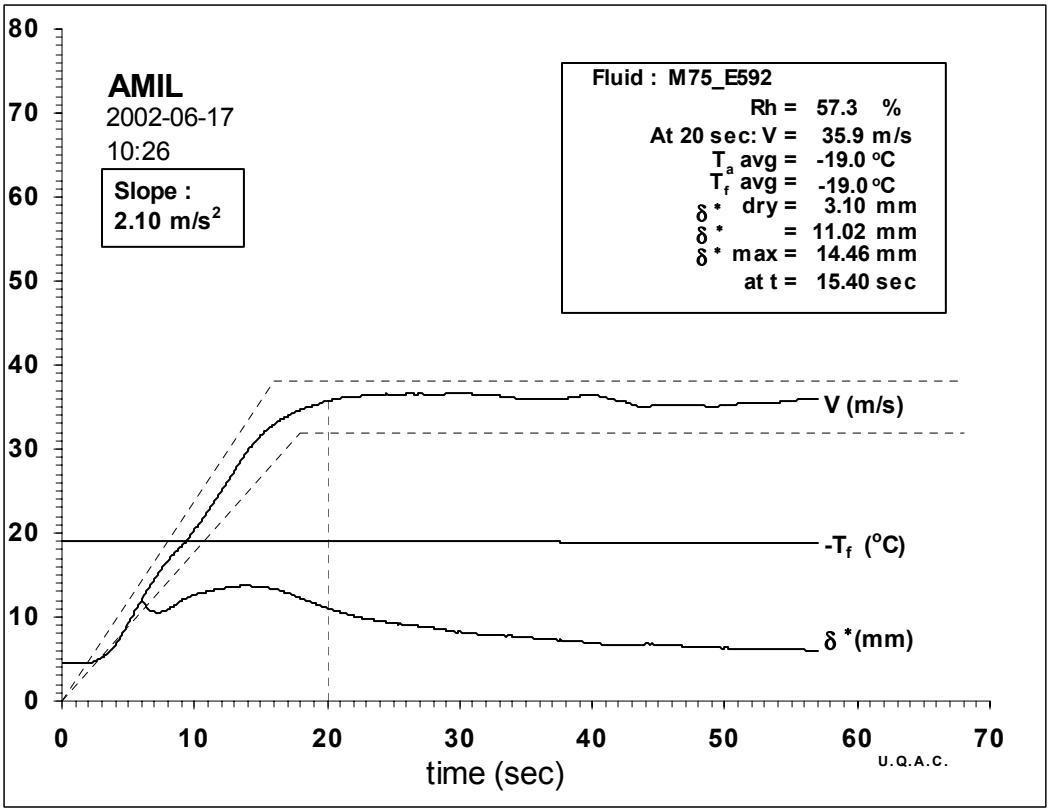
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-21.0	-20.3	56.8	3.43	35.2	0.73	12.34
20	-21.0	-20.3	54.7	3.48	35.4	0.67	11.59
21	-21.0	-20.3	55.6	3.54	35.7	0.64	11.14

Averages :

20	-21.0	**-20.3**	55.4	3.48	35.4	0.68	**11.64**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



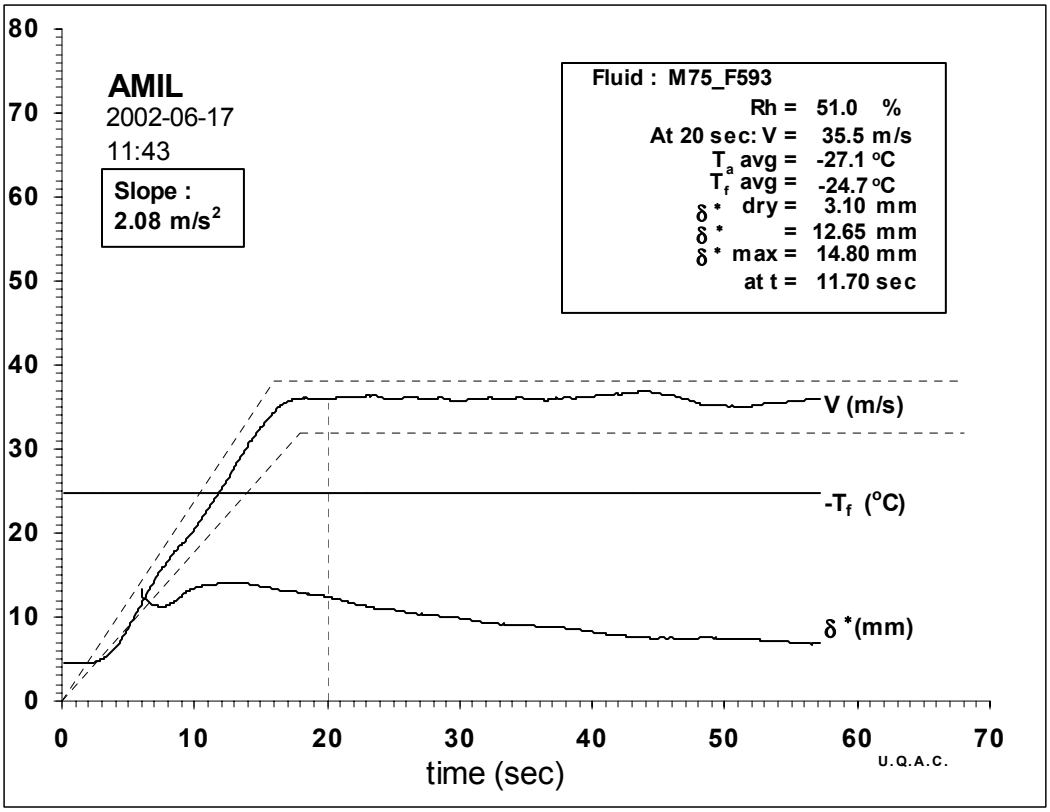
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-19.2	-19.1	56.8	3.52	35.8	0.69	11.73
20	-19.2	-19.1	57.0	3.59	36.1	0.63	10.86
21	-19.1	-19.1	58.4	3.49	35.6	0.60	10.70

Averages :

20	-19.2	**-19.1**	57.3	3.54	35.9	0.63	**11.02**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



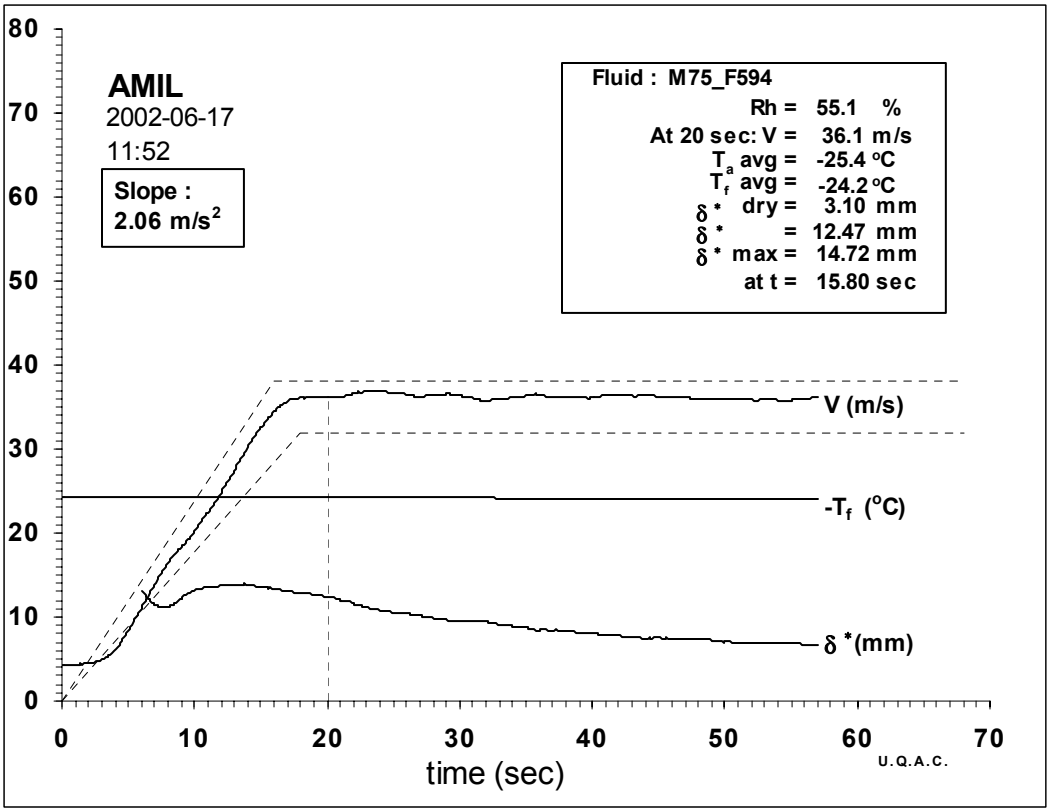
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-27.4	-24.7	50.1	3.57	35.4	0.85	13.24
20	-27.4	-24.7	51.4	3.59	35.5	0.80	12.70
21	-27.3	-24.7	51.2	3.60	35.5	0.74	12.06

Averages :

20	-27.4	**-24.7**	51.0	3.59	35.5	0.79	**12.65**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



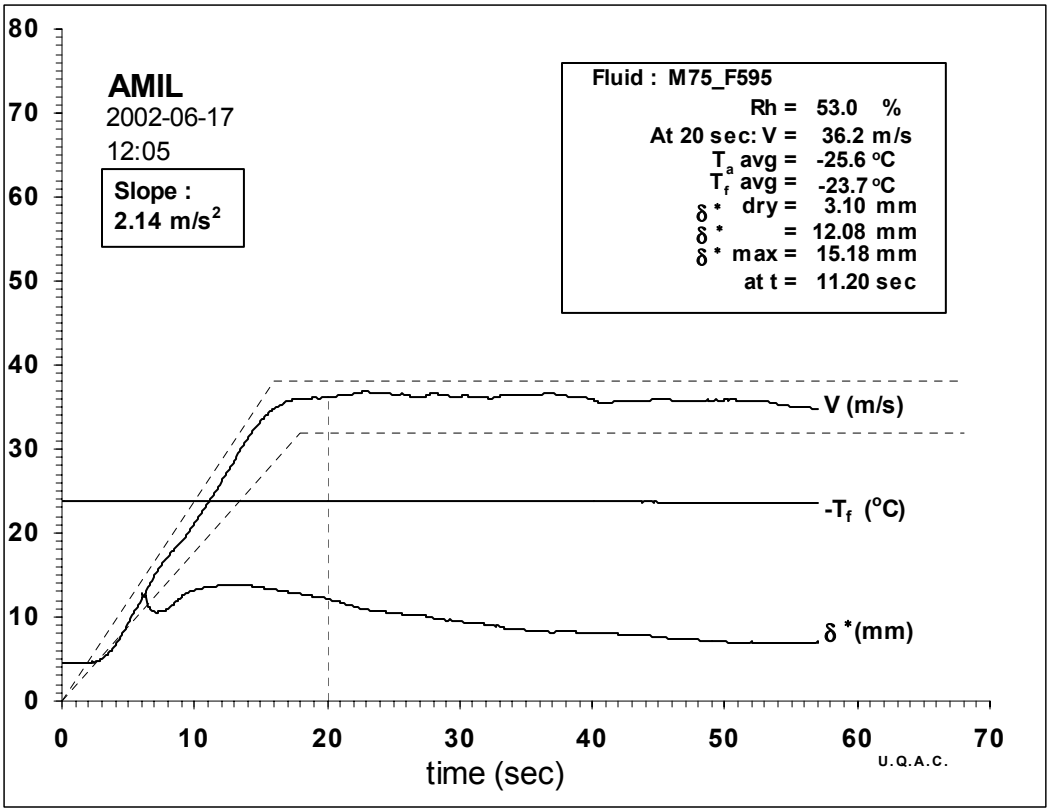
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-25.6	-24.2	55.5	3.58	35.6	0.79	12.66
20	-25.6	-24.2	55.0	3.62	35.8	0.80	12.65
21	-25.6	-24.2	55.0	3.86	36.9	0.79	12.02

Averages :

20	-25.6	**-24.2**	55.1	3.68	36.1	0.80	**12.47**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-26.0	-23.7	52.5	3.59	35.6	0.80	12.66
20	-26.0	-23.7	53.4	3.70	36.2	0.78	12.29
21	-25.9	-23.7	52.8	3.82	36.7	0.71	11.25

Averages :

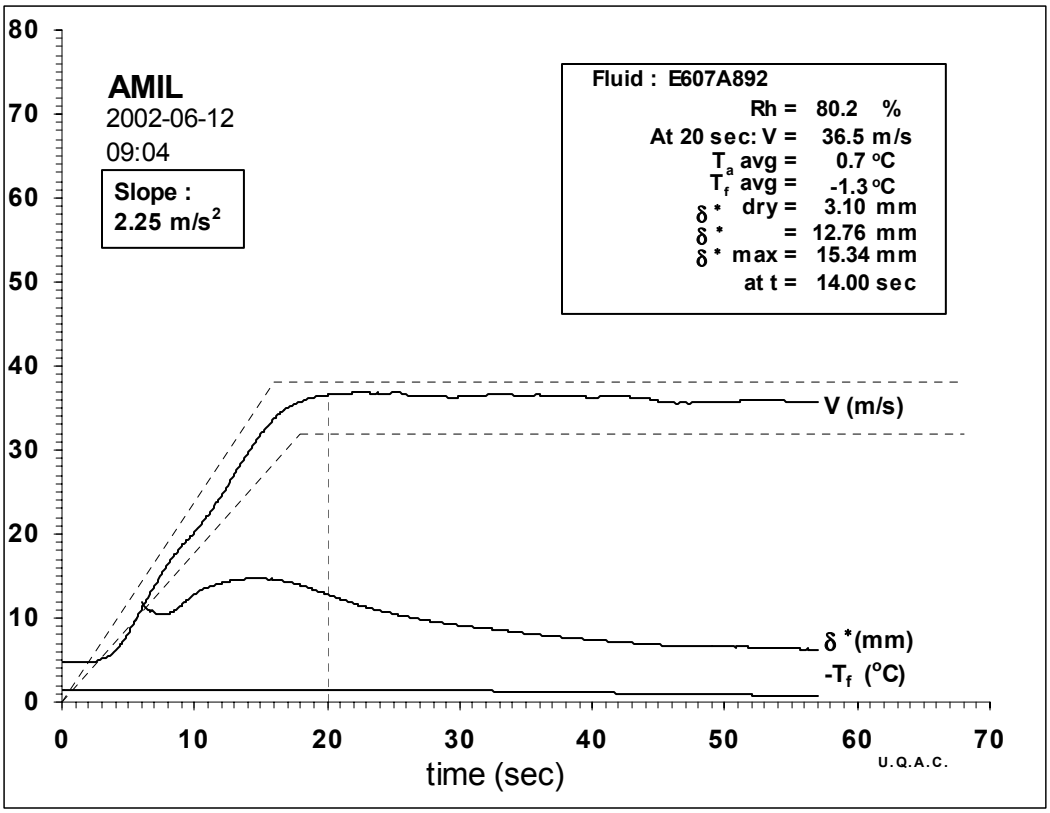
20	-26.0	**-23.7**	53.0	3.71	36.2	0.76	**12.08**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.3 KILFROST ABC-3 LOT H/296/2/02, NEAT E-607.

FP-892



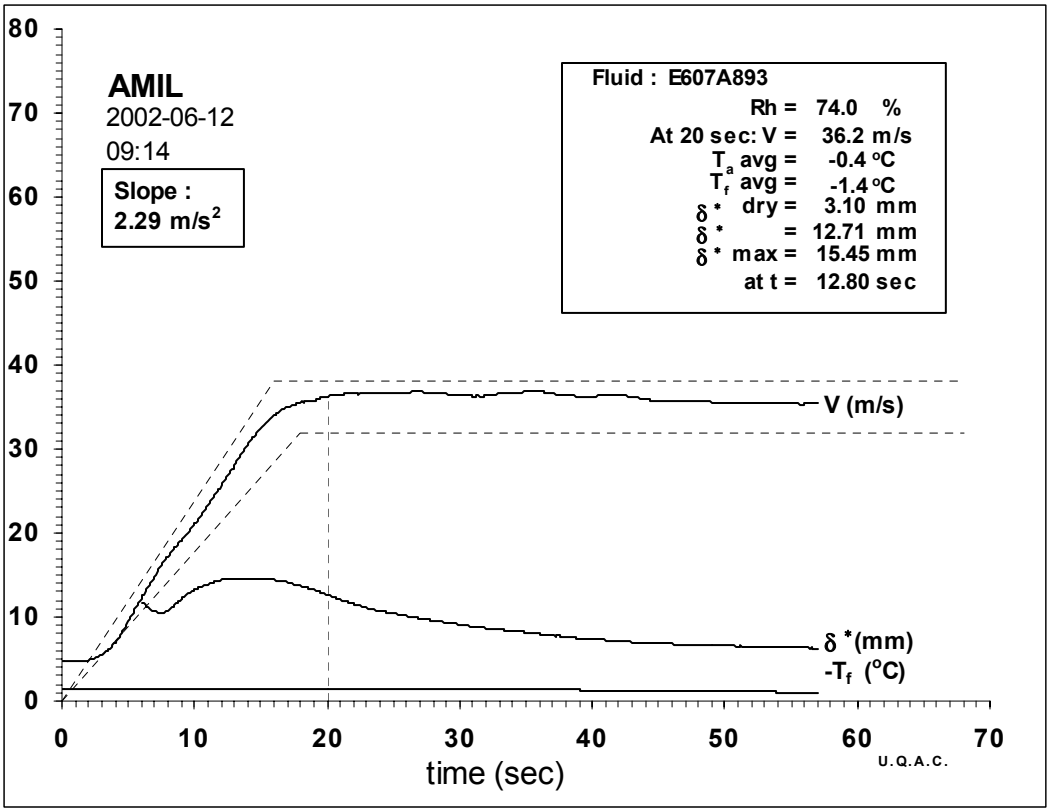
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.6	-1.5	82.3	3.32	36.0	0.82	13.55
20	0.6	-1.5	81.8	3.44	36.6	0.77	12.73
21	0.6	-1.5	75.9	3.44	36.7	0.72	12.15

Averages :

20	0.6	**-1.5**	80.2	3.41	36.5	0.77	**12.76**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



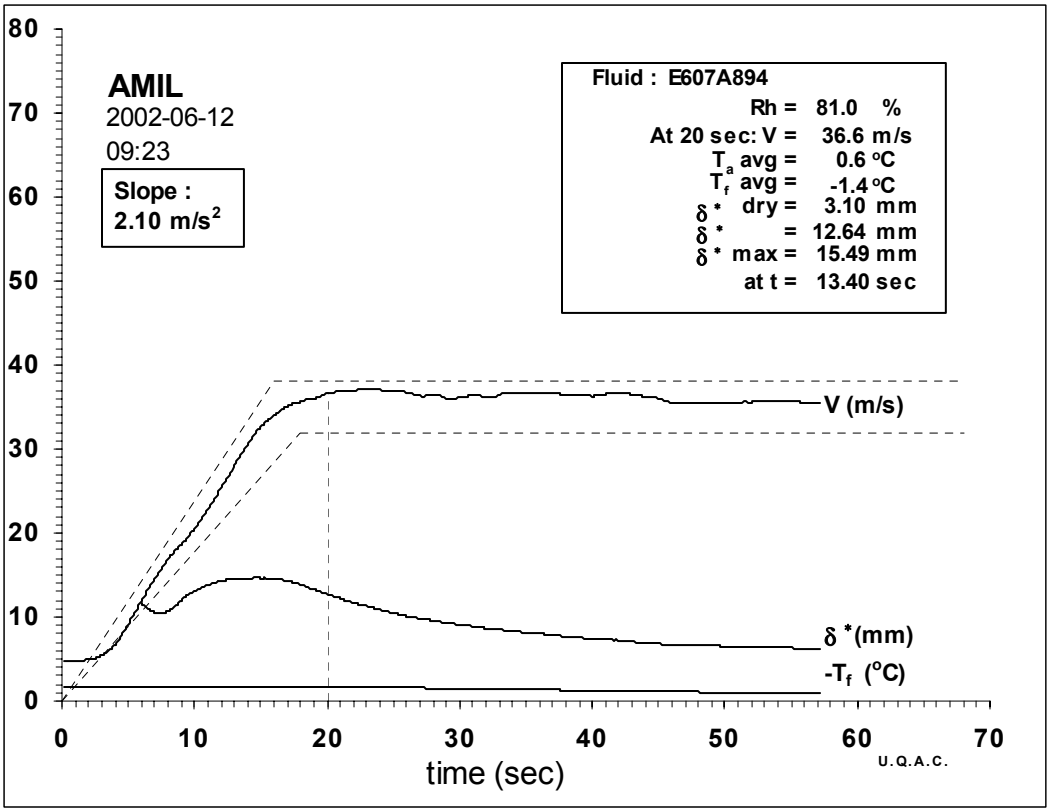
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.7	-1.5	73.5	3.22	35.4	0.76	13.22
20	-0.7	-1.5	73.9	3.42	36.5	0.76	12.63
21	-0.6	-1.5	74.6	3.40	36.4	0.73	12.44

Averages :

20	-0.7	**-1.5**	74.0	3.36	36.2	0.75	**12.71**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



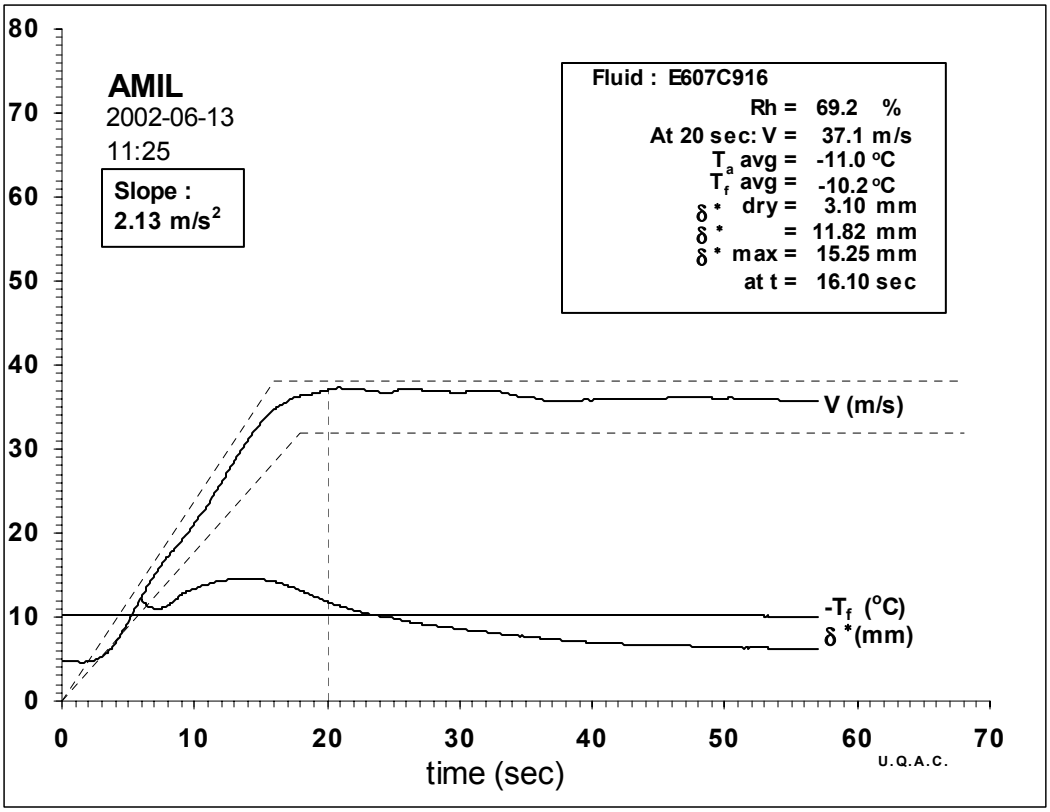
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.4	-1.6	81.1	3.50	37.0	0.84	13.35
20	0.4	-1.6	81.2	3.38	36.3	0.75	12.73
21	0.4	-1.6	80.4	3.46	36.8	0.70	11.91

Averages :

20	0.4	**-1.6**	81.0	3.43	36.6	0.76	**12.64**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



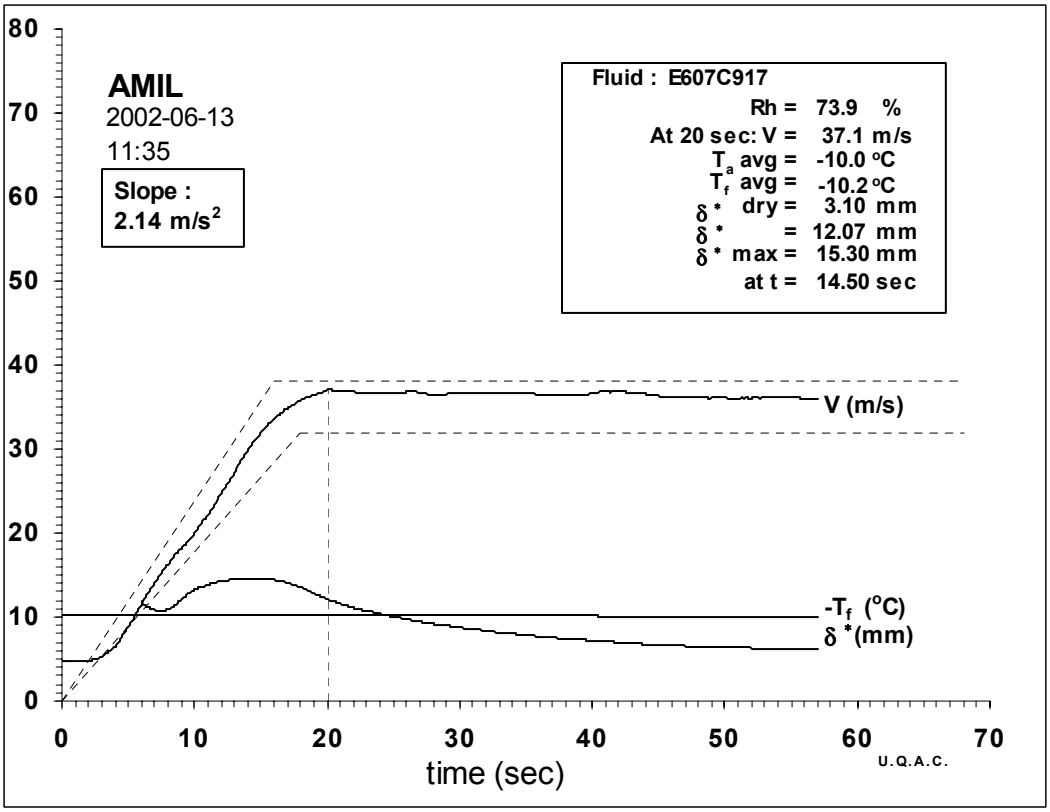
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-11.2	-10.3	68.1	3.73	37.4	0.76	12.02
20	-11.2	-10.3	68.4	3.58	36.6	0.72	11.92
21	-11.2	-10.3	71.3	3.77	37.6	0.72	11.50

Averages :

20	-11.2	**-10.3**	69.2	3.67	37.1	0.73	**11.82**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



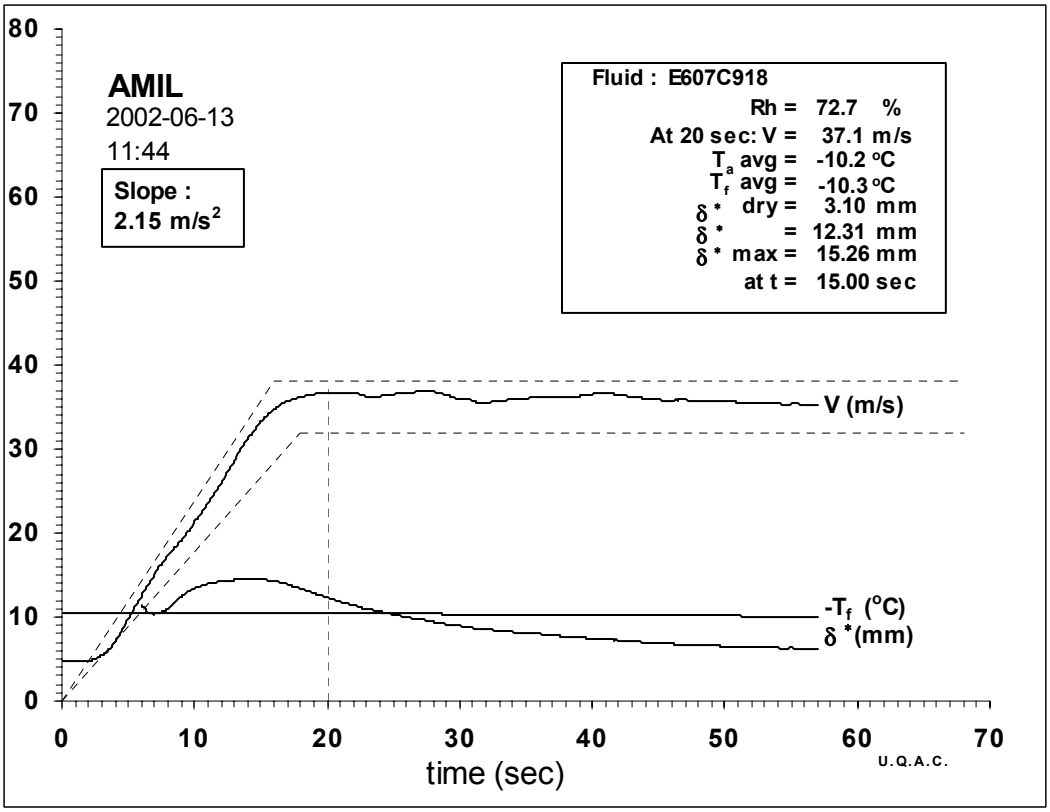
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.2	-10.3	73.4	3.52	36.3	0.78	12.63
20	-10.2	-10.3	72.4	3.70	37.3	0.78	12.23
21	-10.2	-10.3	76.9	3.75	37.5	0.70	11.33

Averages :

20	-10.2	**-10.3**	73.9	3.67	37.1	0.76	**12.07**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



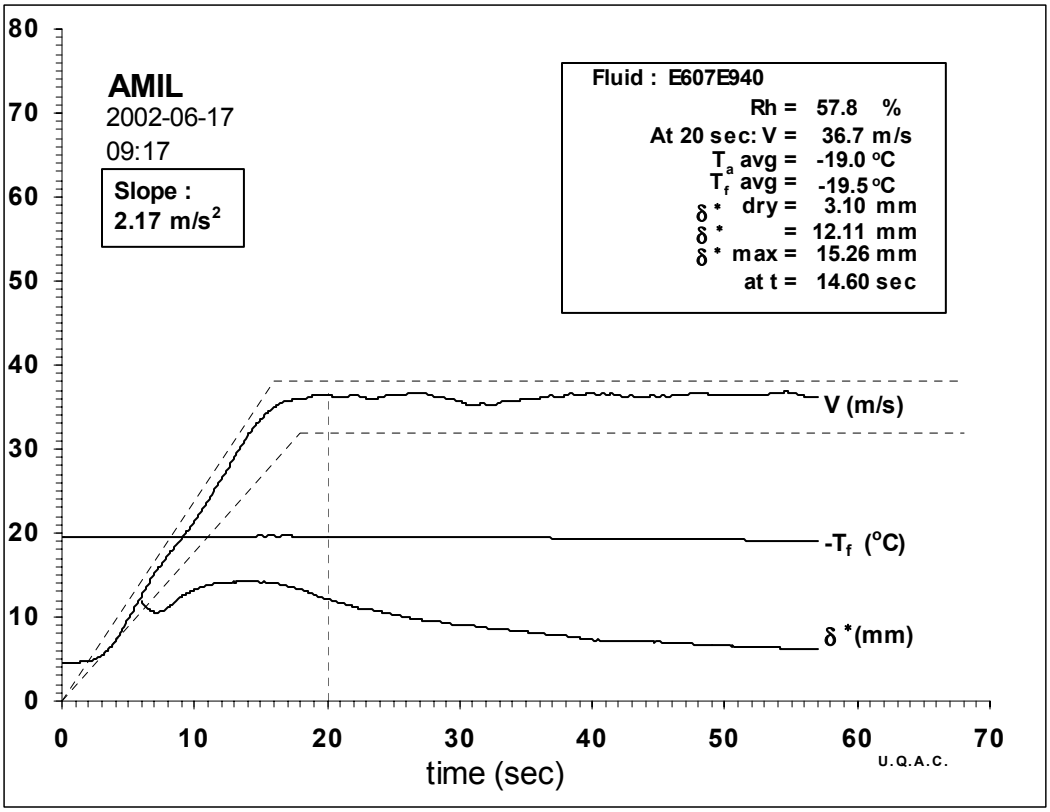
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.5	-10.4	70.5	3.60	36.7	0.80	12.67
20	-10.5	-10.4	74.2	3.67	37.1	0.78	12.34
21	-10.5	-10.4	72.0	3.72	37.4	0.76	11.95

Averages :

20	-10.5	**-10.4**	72.7	3.67	37.1	0.78	**12.31**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



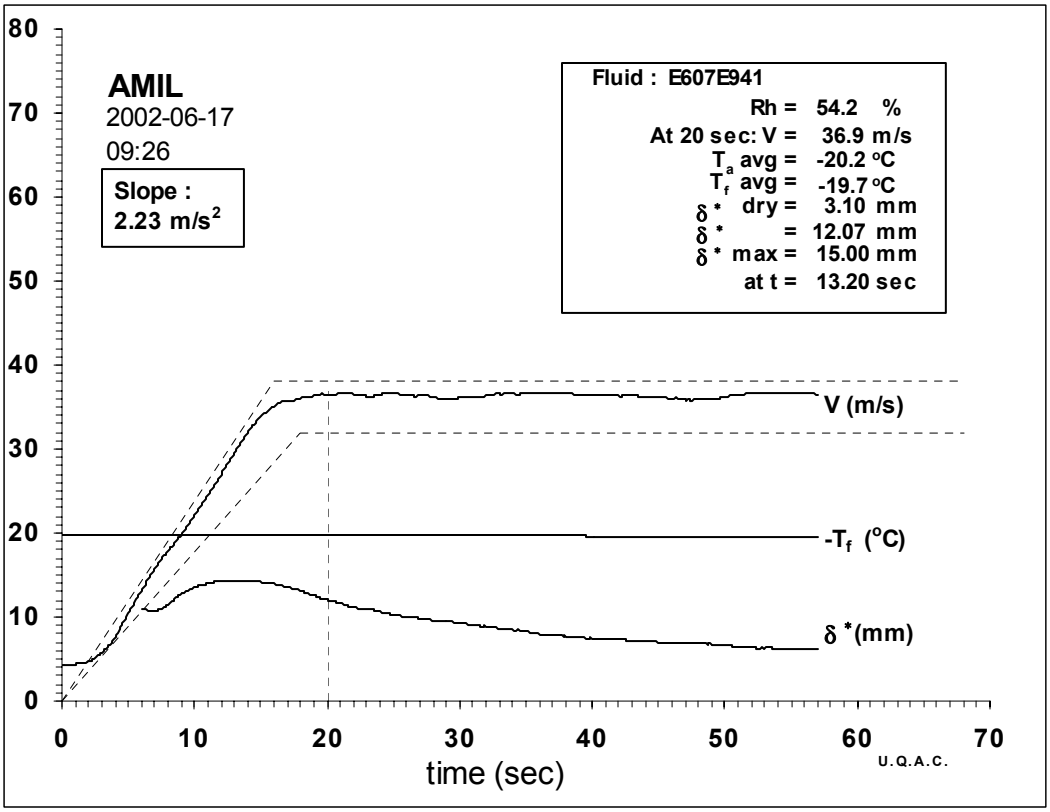
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-19.2	-19.6	57.3	3.53	35.8	0.77	12.56
20	-19.2	-19.6	58.4	3.63	36.3	0.78	12.36
21	-19.2	-19.6	57.4	3.97	38.0	0.74	11.31

Averages :

20	-19.2	**-19.6**	57.8	3.71	36.7	0.77	**12.11**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



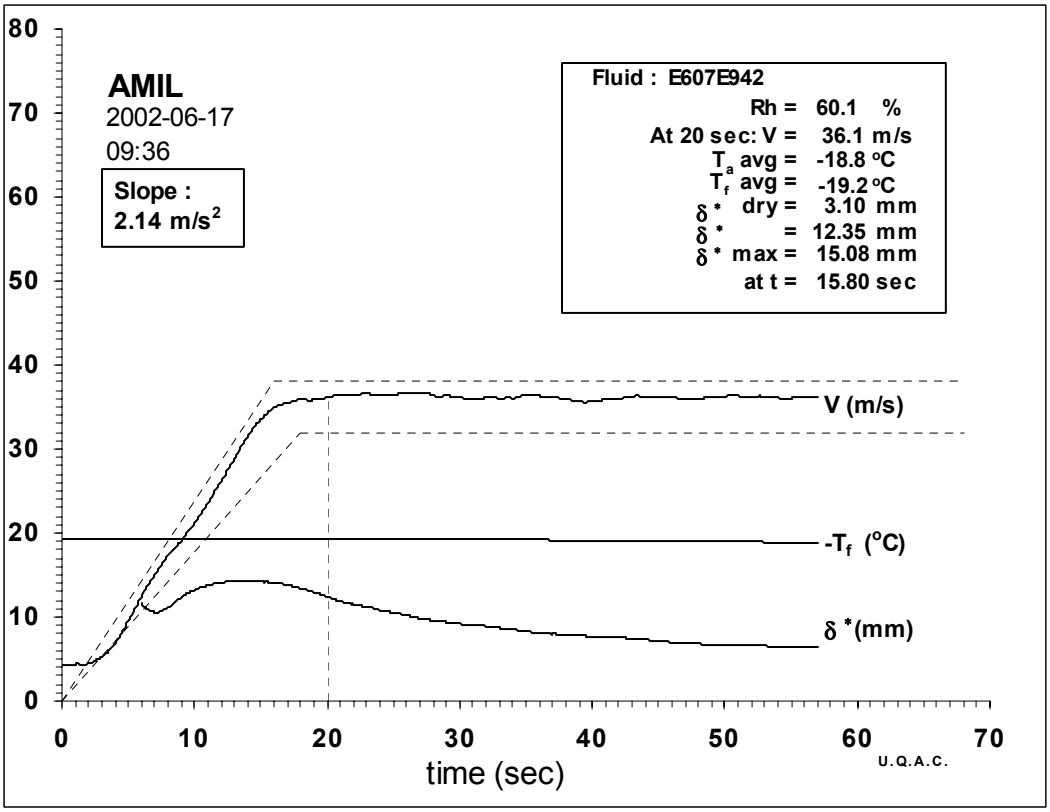
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-20.6	-19.8	59.3	3.50	35.5	0.81	13.01
20	-20.6	-19.8	52.4	3.82	37.1	0.77	11.87
21	-20.6	-19.7	53.0	3.91	37.5	0.76	11.62

Averages :

20	-20.6	**-19.8**	54.2	3.77	36.9	0.78	**12.07**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-19.1	-19.4	58.5	3.49	35.6	0.78	12.76
20	-19.0	-19.4	62.1	3.69	36.6	0.78	12.27
21	-19.0	-19.4	58.3	3.48	35.6	0.73	12.15

Averages :

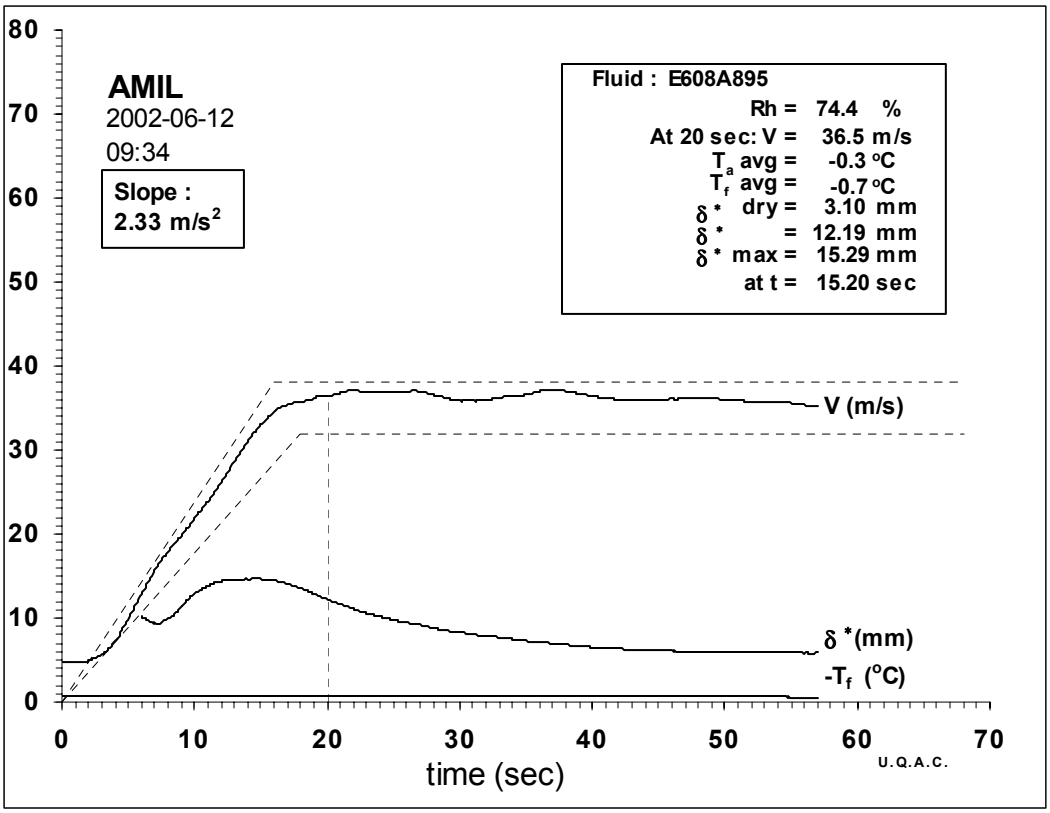
20	-19.0	**-19.4**	60.1	3.58	36.1	0.77	**12.35**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.4 KILFROST ABC-3 LOT H/296/2/02, 75/25 DILUTION E-608.

FP-895



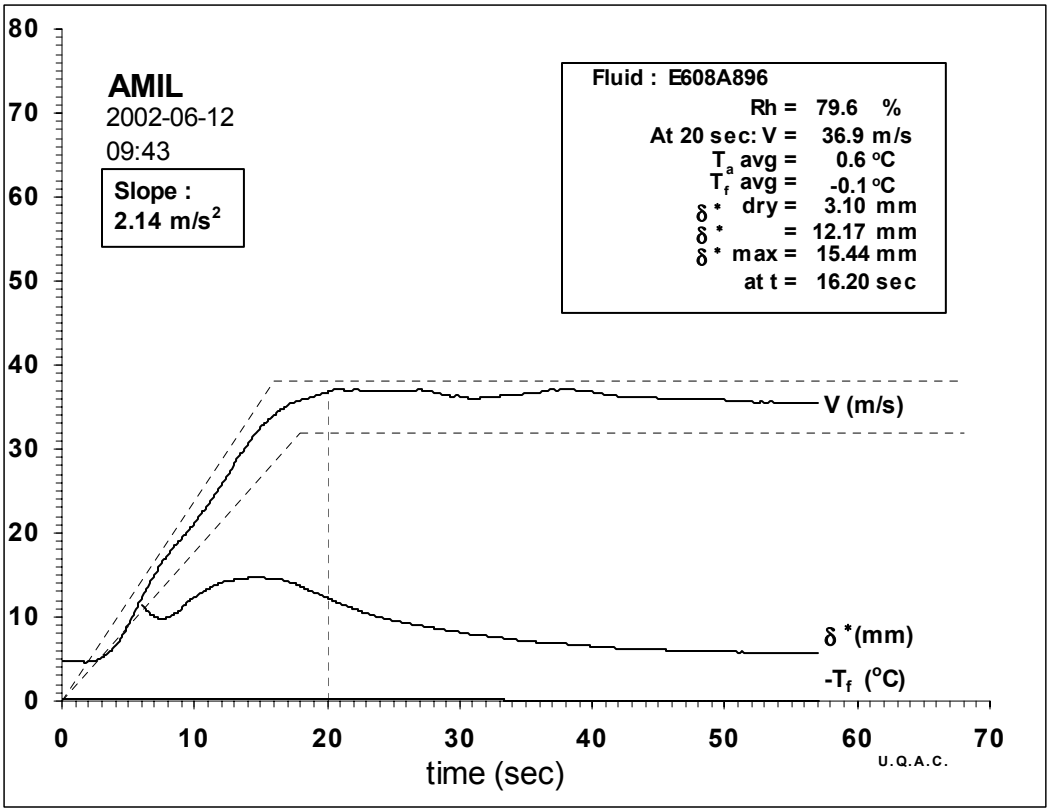
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.6	-0.8	76.2	3.31	35.9	0.74	12.67
20	-0.6	-0.8	73.8	3.42	36.5	0.72	12.23
21	-0.6	-0.8	74.0	3.52	37.0	0.70	11.72

Averages :

20	-0.6	**-0.8**	74.4	3.42	36.5	0.72	**12.19**

Test Duct Dimensions :

S_2 = 30570.314 mm² S_3 = 33094.834 mm² B_3 = 301.82 mm C_3 = 822.97 mm



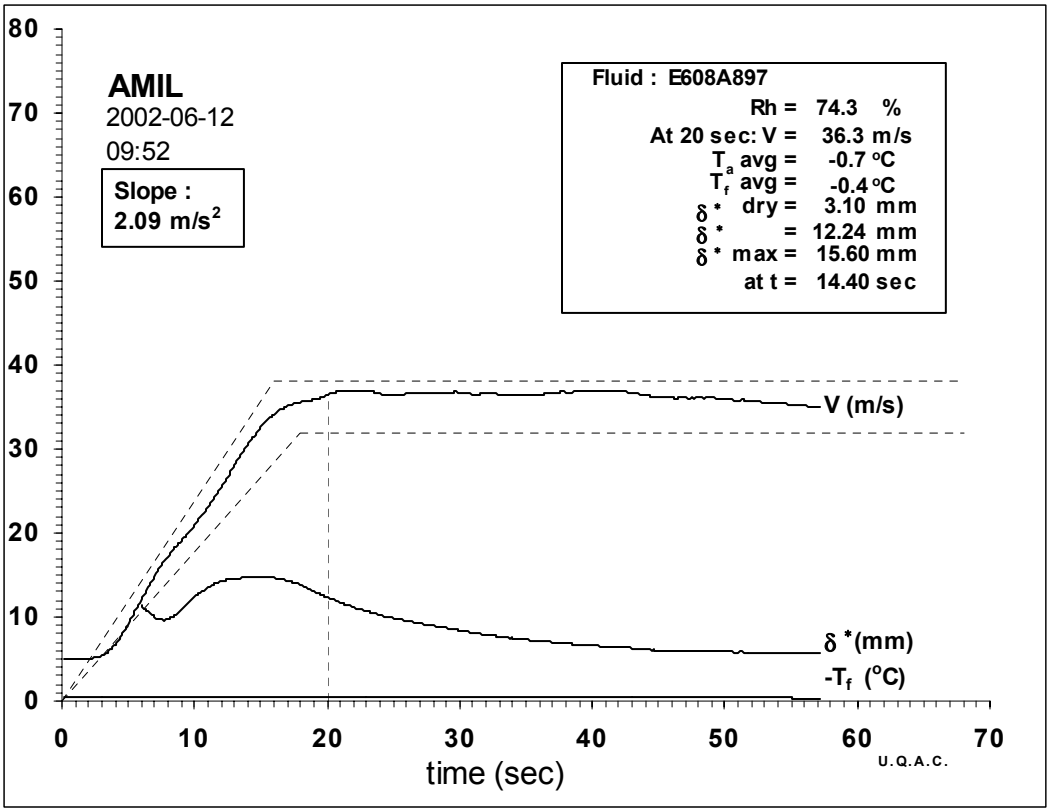
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.4	-0.2	79.4	3.52	37.1	0.78	12.63
20	0.4	-0.2	79.5	3.41	36.5	0.72	12.20
21	0.4	-0.2	79.8	3.58	37.4	0.71	11.74

Averages :

20	0.4	**-0.2**	79.6	3.48	36.9	0.73	**12.17**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



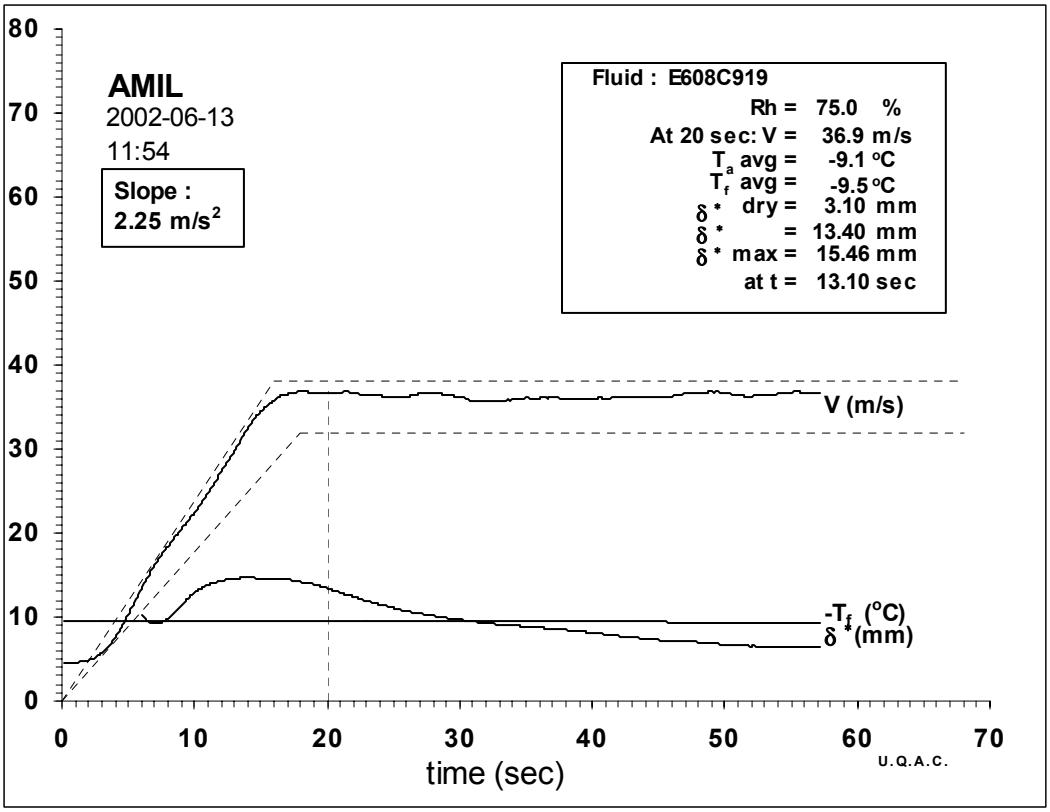
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.9	-0.4	71.4	3.28	35.7	0.74	12.82
20	-0.9	-0.4	73.7	3.42	36.4	0.72	12.30
21	-0.9	-0.4	77.6	3.43	36.5	0.67	11.64

Averages :

20	-0.9	**-0.4**	74.3	3.39	36.3	0.71	**12.24**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



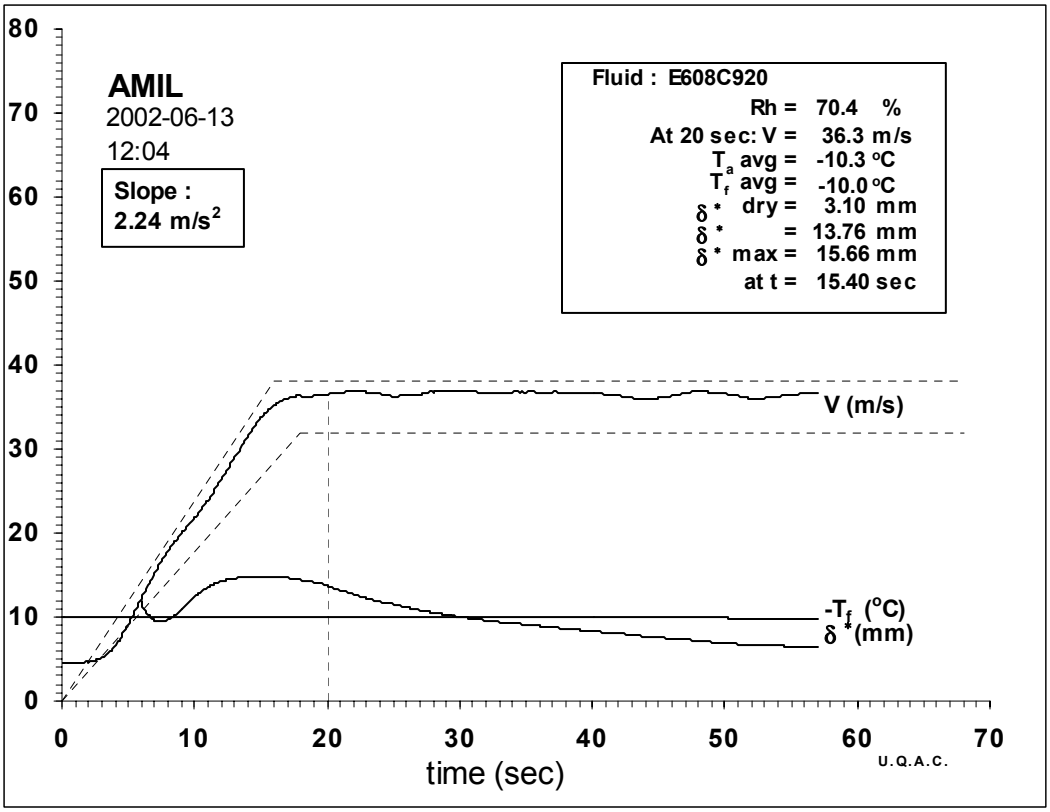
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-9.3	-9.6	74.6	3.55	36.6	0.89	13.76
20	-9.2	-9.6	75.2	3.67	37.2	0.89	13.41
21	-9.3	-9.6	75.0	3.55	36.6	0.83	13.09

Averages :

20	-9.3	**-9.6**	75.0	3.61	36.9	0.87	**13.40**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



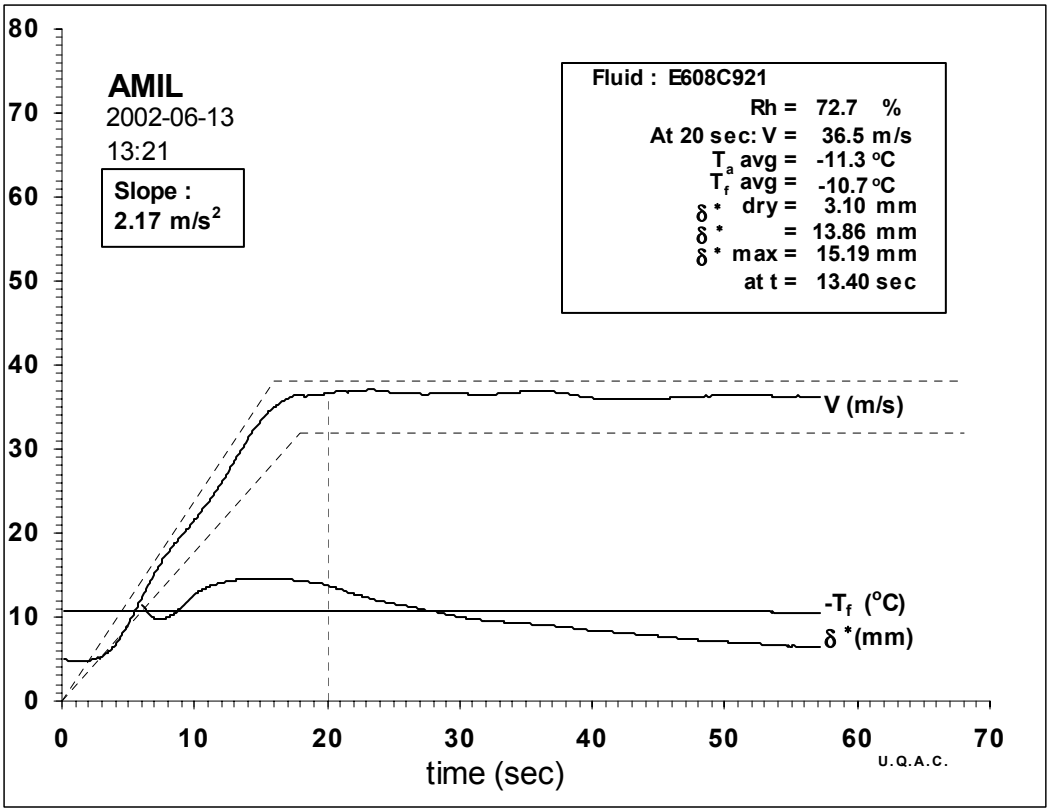
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.6	-10.0	75.4	3.35	35.5	0.88	14.18
20	-10.6	-10.0	69.3	3.54	36.4	0.88	13.65
21	-10.6	-10.0	68.0	3.60	36.8	0.89	13.60

Averages :

20	-10.6	**-10.0**	70.4	3.51	36.3	0.88	**13.76**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



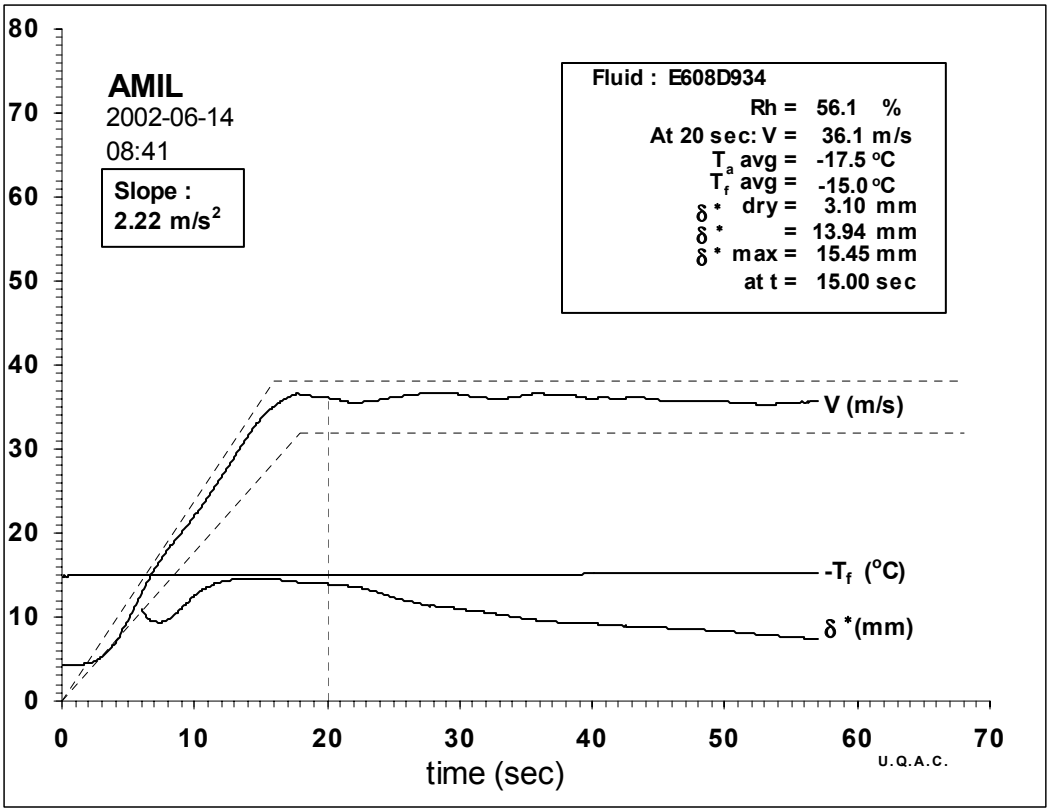
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-11.5	-10.8	68.3	3.63	36.9	0.98	14.39
20	-11.5	-10.8	76.2	3.50	36.2	0.89	13.82
21	-11.5	-10.8	70.7	3.63	36.8	0.89	13.49

Averages :

20	-11.5	**-10.8**	72.7	3.57	36.5	0.91	**13.86**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



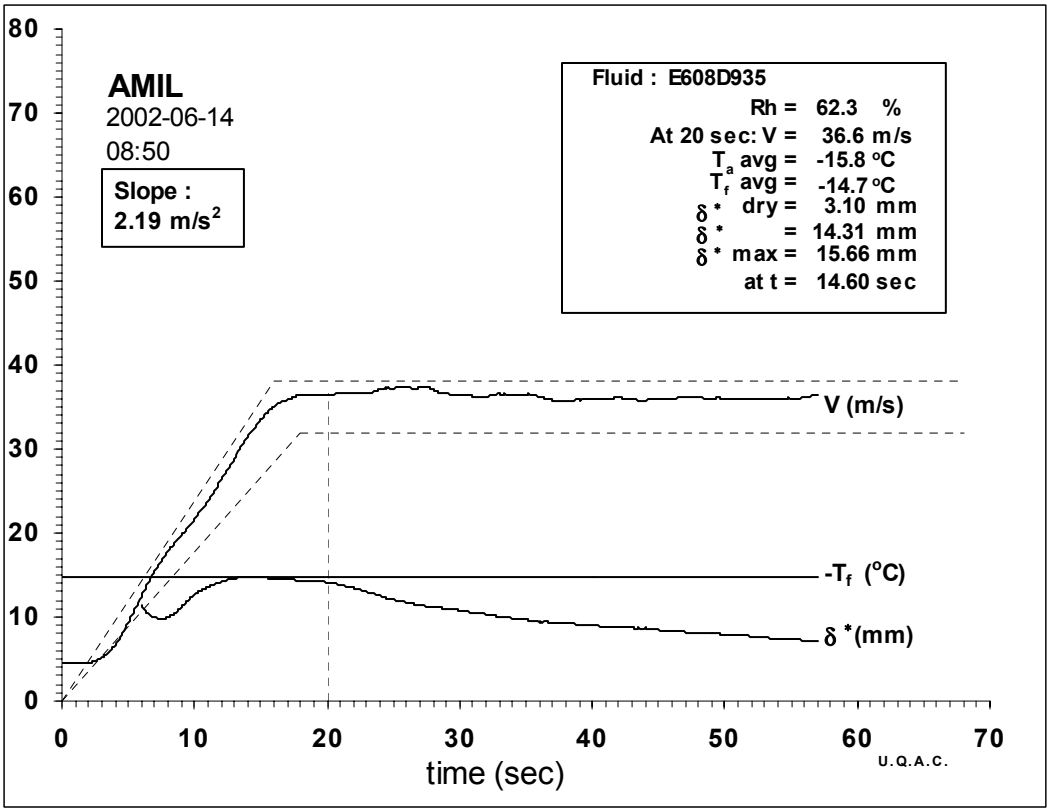
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-17.8	-15.0	56.7	3.83	37.4	0.98	13.94
20	-17.8	-15.0	54.0	3.57	36.1	0.90	13.78
21	-17.8	-15.0	59.0	3.40	35.2	0.90	14.21

Averages :

20	-17.8	**-15.0**	56.1	3.59	36.1	0.92	**13.94**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



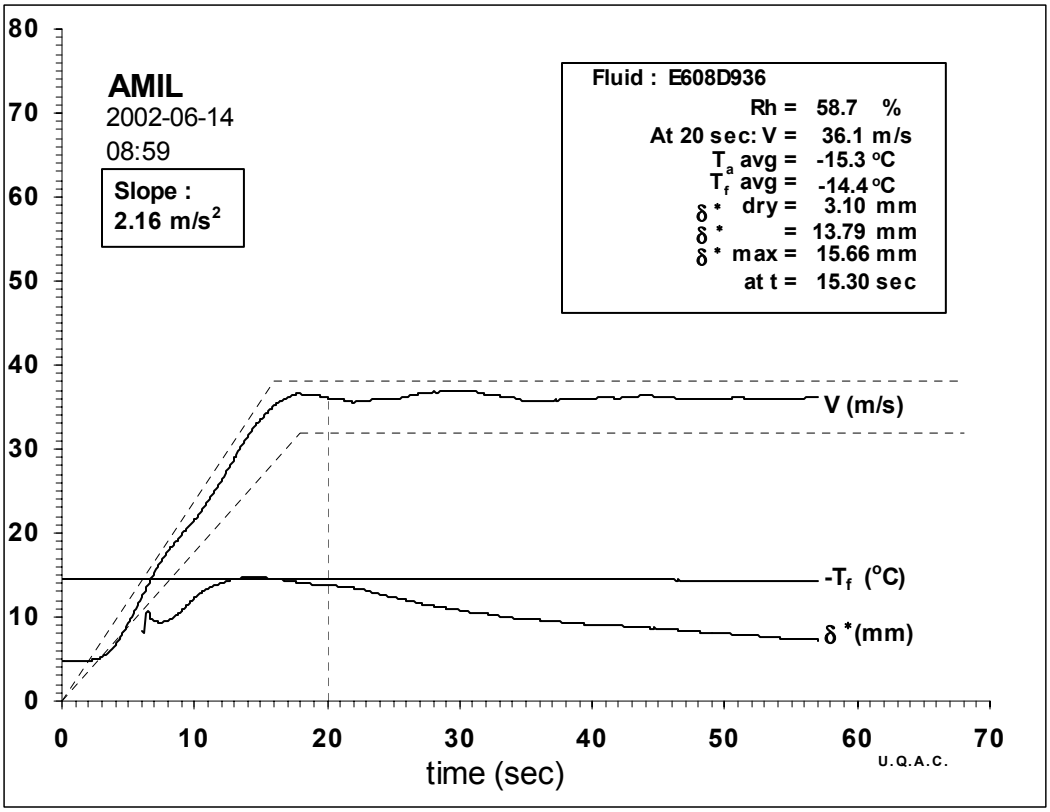
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-16.1	-14.8	59.3	3.67	36.7	1.00	14.52
20	-16.1	-14.8	61.1	3.68	36.8	0.98	14.29
21	-16.1	-14.8	66.7	3.60	36.4	0.95	14.17

Averages :

20	-16.1	**-14.8**	62.3	3.65	36.6	0.98	**14.31**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-15.5	-14.5	58.0	3.79	37.3	0.96	13.80
20	-15.5	-14.5	59.8	3.51	35.9	0.88	13.72
21	-15.5	-14.5	57.6	3.40	35.4	0.87	13.90

Averages :

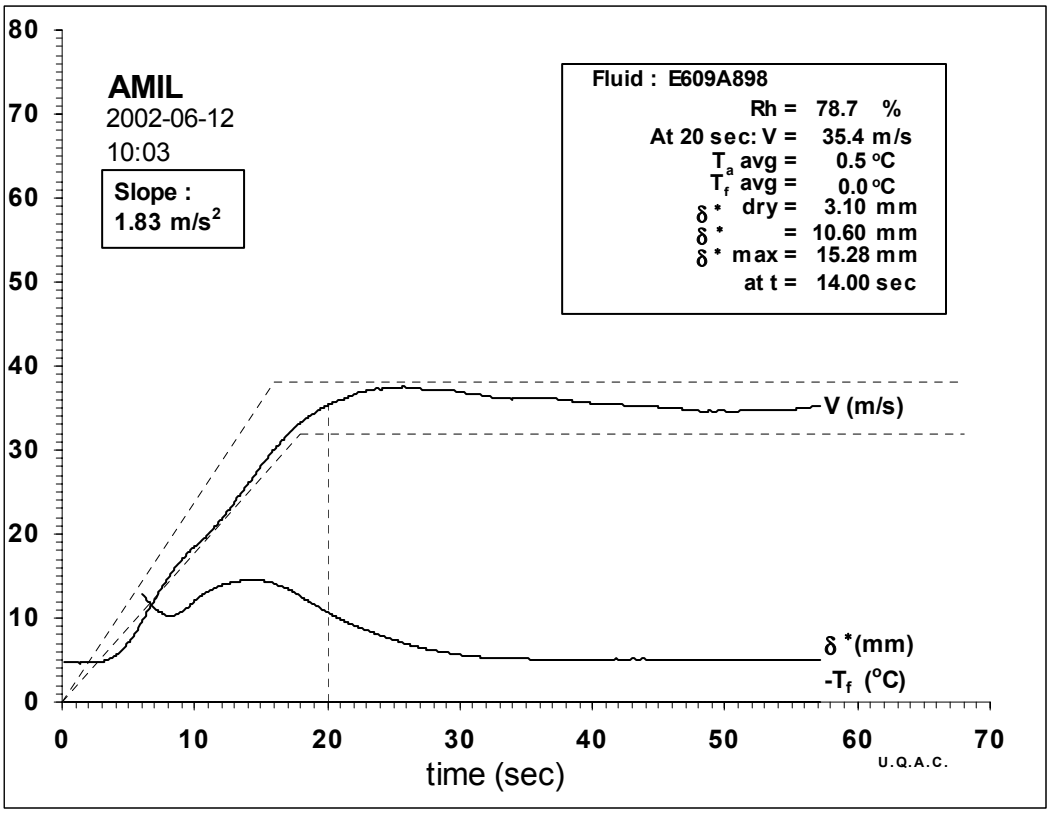
20	-15.5	**-14.5**	58.7	3.55	36.1	0.89	**13.79**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.5 KILFROST ABC-3 LOT H/296/2/02, 50/50 DILUTION E-609.

FP-898



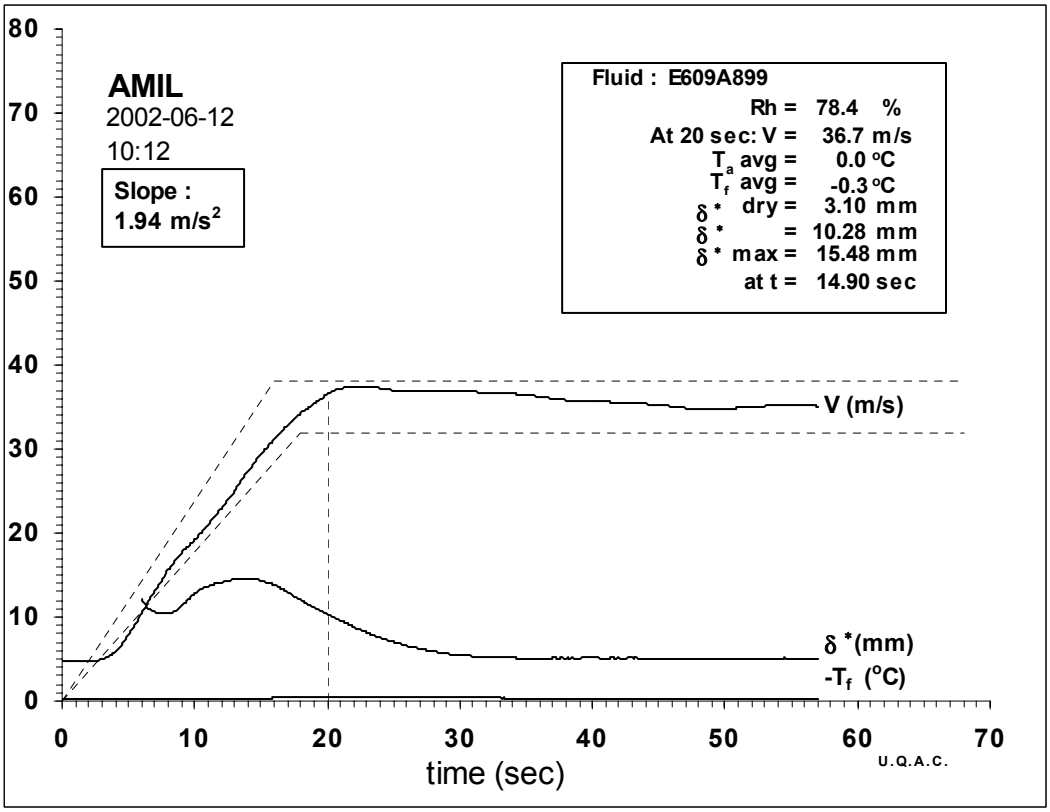
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.3	-0.1	80.3	3.12	34.9	0.59	11.40
20	0.3	-0.1	77.6	3.17	35.2	0.54	10.60
21	0.3	-0.1	79.2	3.35	36.2	0.51	9.94

Averages :

20	0.3	**-0.1**	78.7	3.21	35.4	0.54	**10.60**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



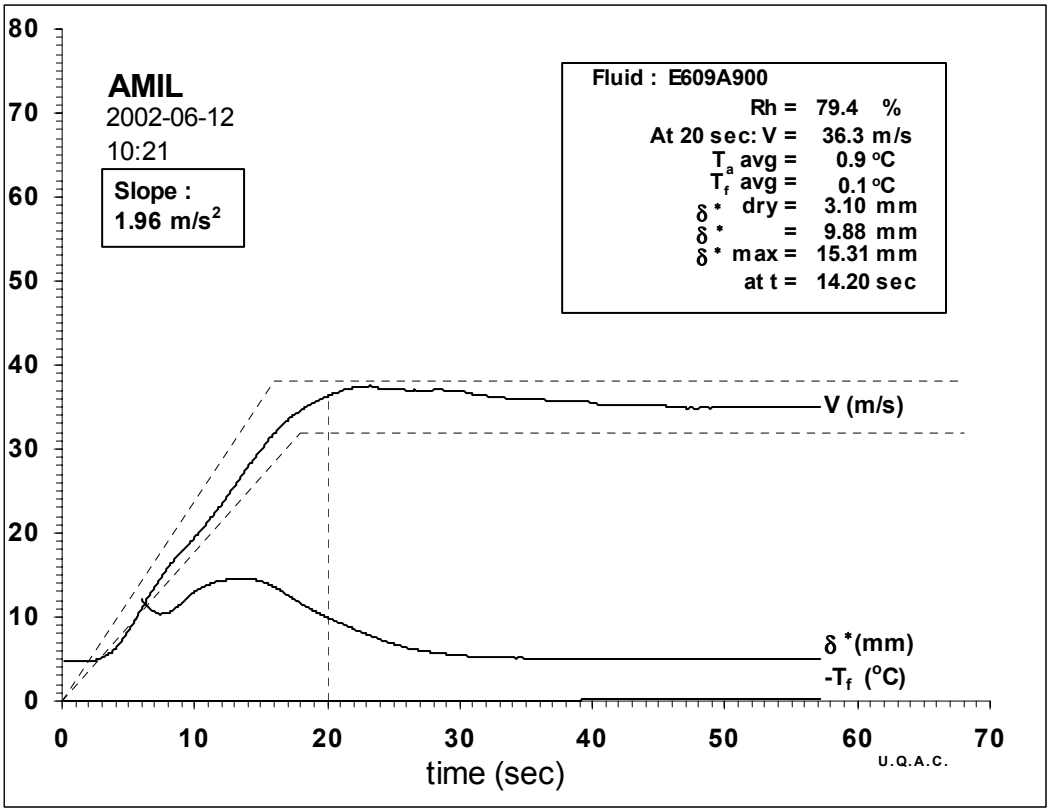
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.3	-0.4	79.4	3.37	36.2	0.61	11.09
20	-0.3	-0.4	76.9	3.45	36.7	0.55	10.26
21	-0.3	-0.4	80.0	3.57	37.3	0.52	9.65

Averages :

20	-0.3	**-0.4**	78.4	3.46	36.7	0.56	**10.28**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



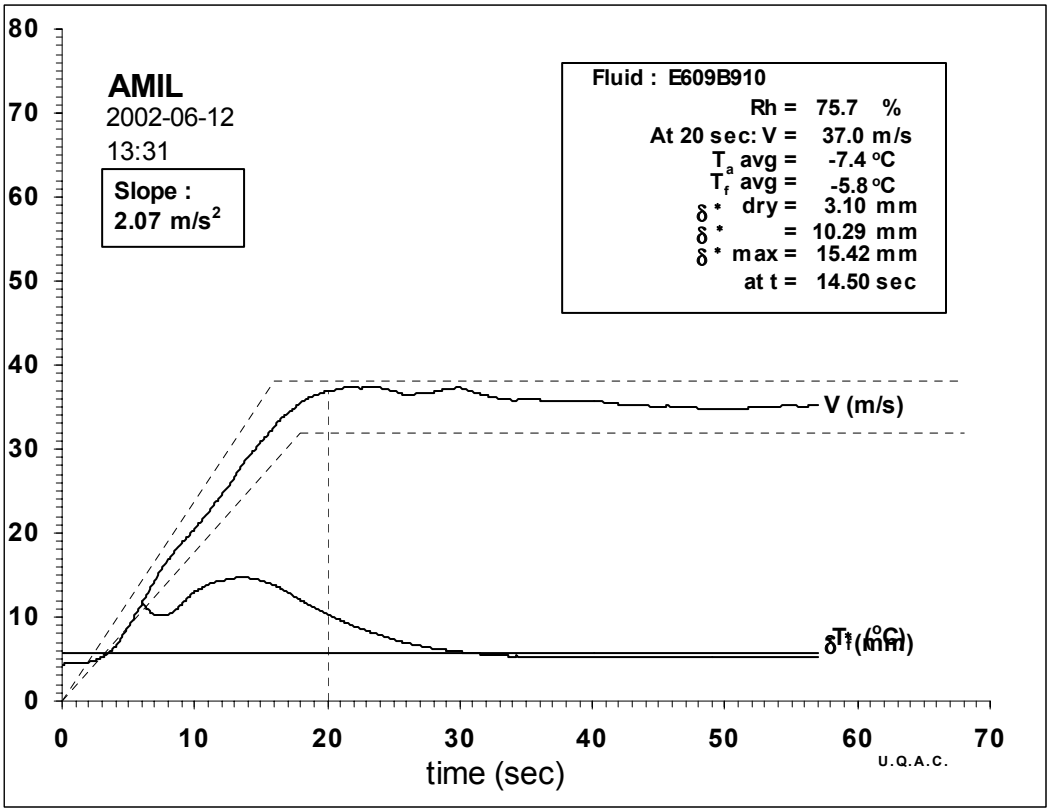
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.6	0.0	81.2	3.23	35.5	0.55	10.64
20	0.7	0.0	79.7	3.37	36.3	0.52	9.97
21	0.7	0.0	77.4	3.46	36.8	0.46	9.11

Averages :

20	0.7	**0.0**	79.4	3.36	36.3	0.51	**9.88**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



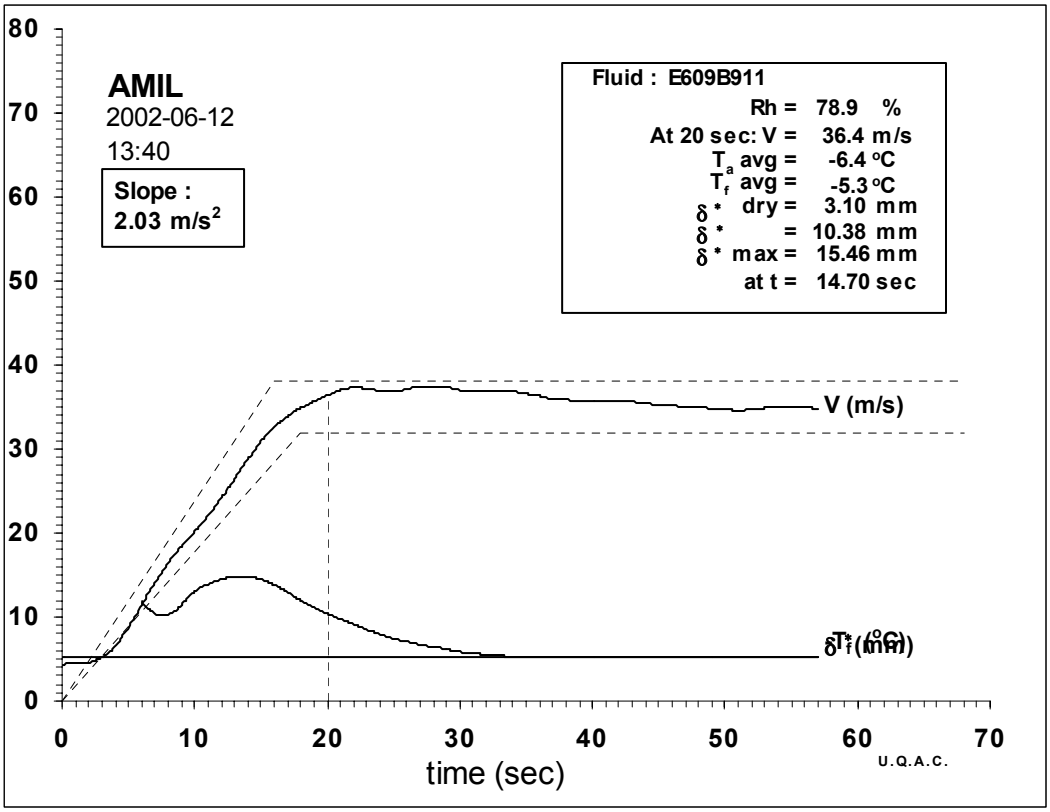
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-7.5	-5.7	75.6	3.62	37.0	0.65	11.02
20	-7.5	-5.7	74.8	3.66	37.3	0.59	10.32
21	-7.5	-5.7	77.4	3.52	36.6	0.51	9.65

Averages :

20	-7.5	**-5.7**	75.7	3.61	37.0	0.58	**10.29**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



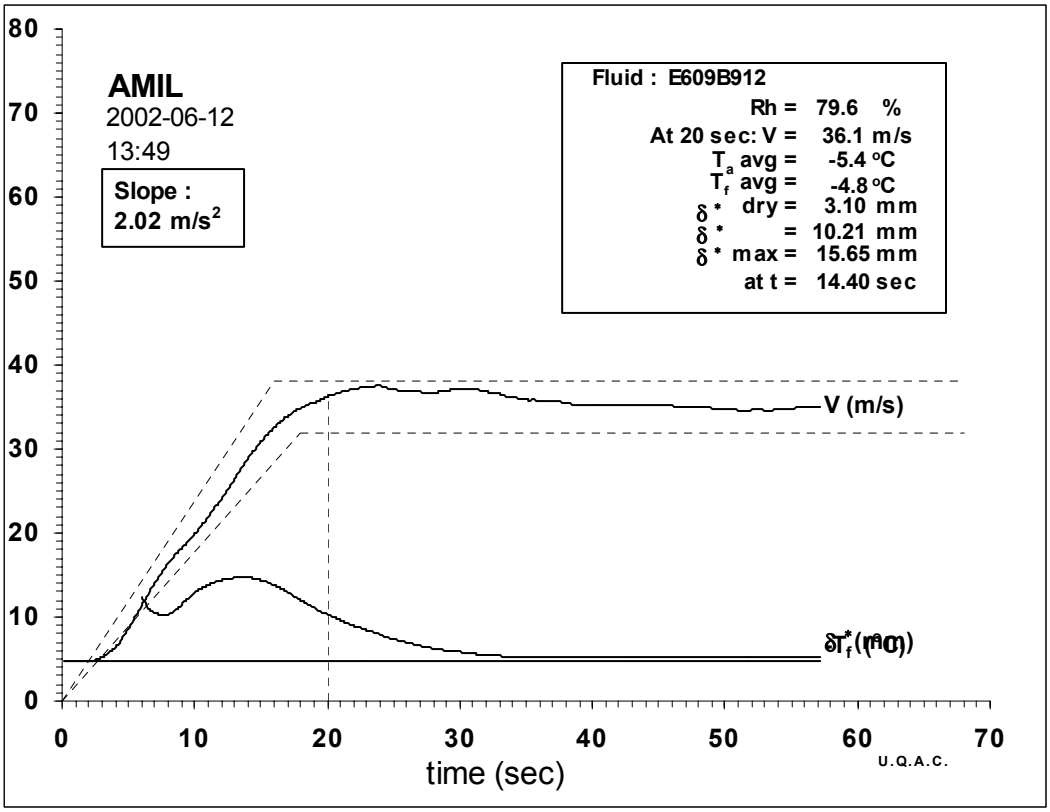
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-6.5	-5.3	78.4	3.36	35.8	0.60	11.05
20	-6.5	-5.3	79.9	3.44	36.2	0.56	10.31
21	-6.5	-5.3	77.7	3.65	37.3	0.56	9.95

Averages :

20	-6.5	**-5.3**	78.9	3.48	36.4	0.57	**10.38**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



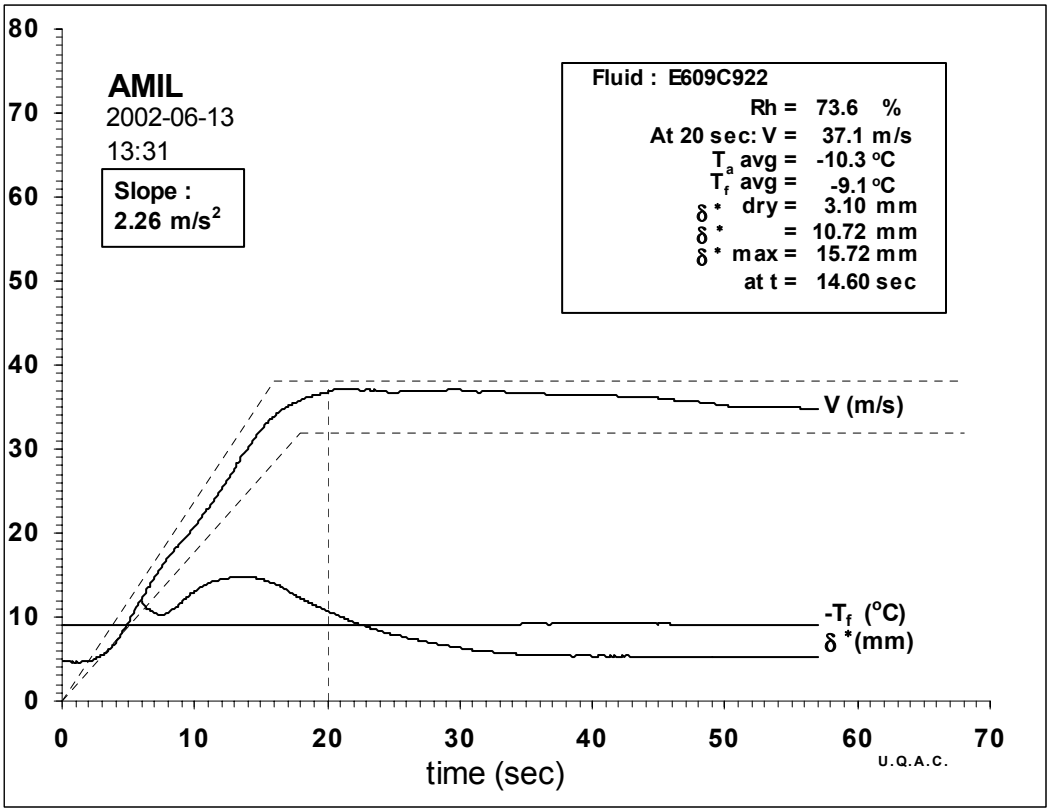
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-5.6	-4.8	73.8	3.32	35.6	0.58	10.83
20	-5.5	-4.8	80.4	3.42	36.2	0.55	10.29
21	-5.5	-4.8	83.1	3.47	36.4	0.50	9.56

Averages :

20	-5.5	**-4.8**	79.6	3.41	36.1	0.54	**10.21**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



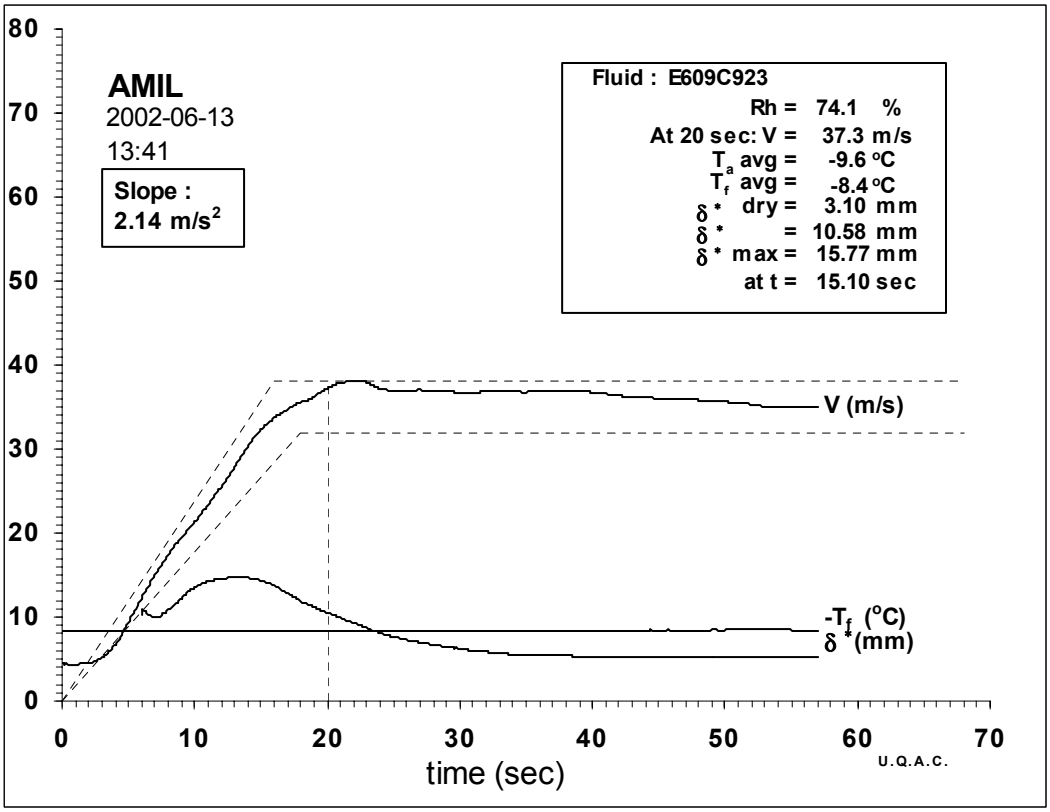
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.4	-9.1	73.6	3.53	36.4	0.65	11.16
20	-10.4	-9.1	73.7	3.72	37.4	0.65	10.84
21	-10.4	-9.1	73.4	3.66	37.1	0.58	10.16

Averages :

20	-10.4	**-9.1**	73.6	3.66	37.1	0.63	**10.72**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



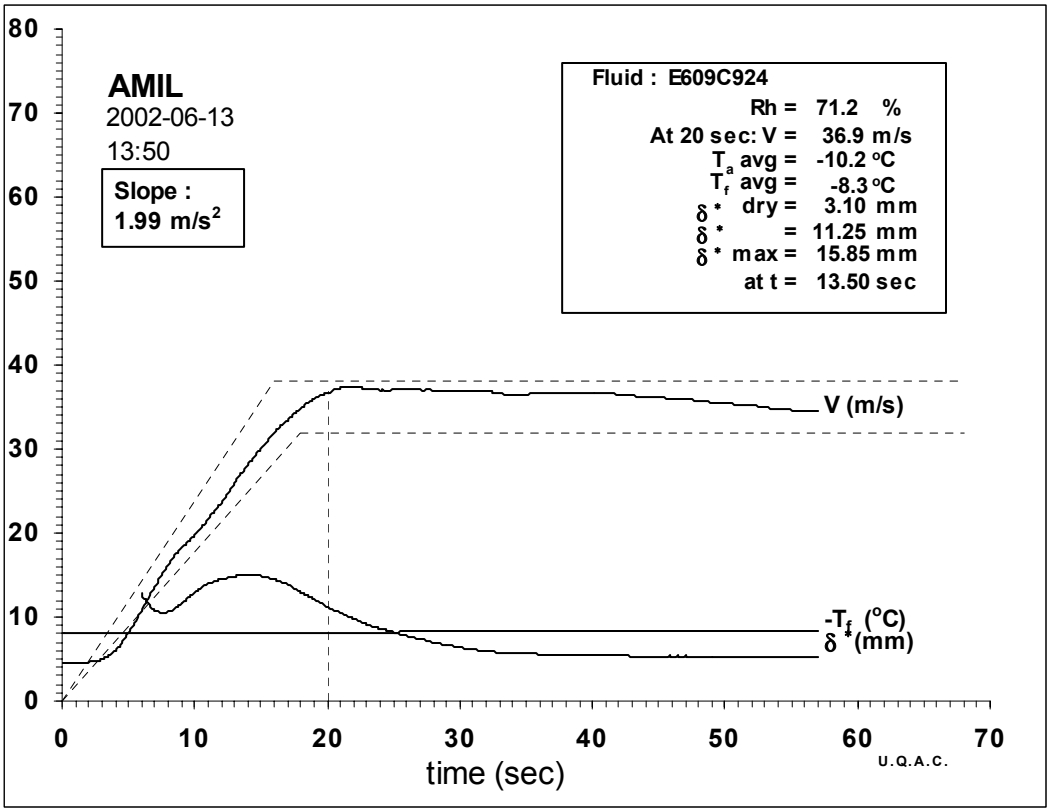
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-9.8	-8.4	74.5	3.65	37.1	0.66	11.09
20	-9.8	-8.4	74.5	3.61	36.8	0.60	10.47
21	-9.7	-8.4	72.9	3.90	38.3	0.63	10.35

Averages :

20	-9.8	**-8.4**	74.1	3.70	37.3	0.62	**10.58**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-10.5	-8.2	75.9	3.52	36.4	0.71	11.84
20	-10.5	-8.2	68.7	3.66	37.1	0.67	11.21
21	-10.5	-8.2	71.5	3.65	37.0	0.64	10.82

Averages :

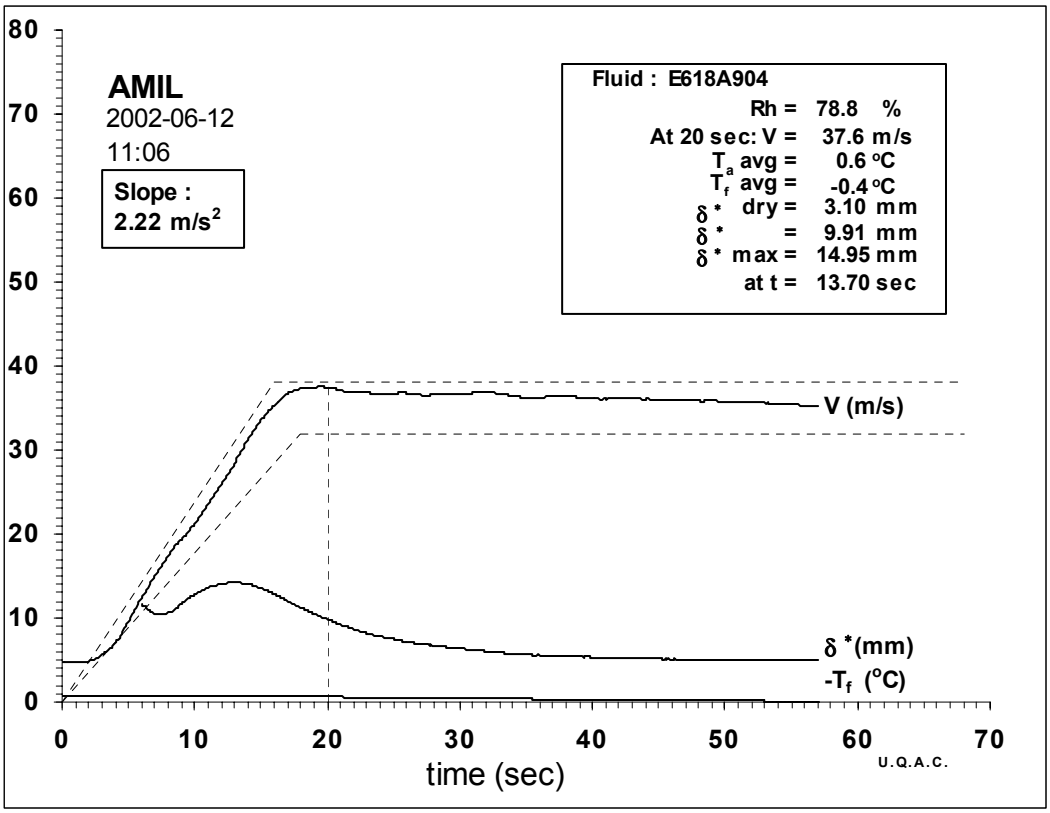
20	-10.5	**-8.2**	71.2	3.62	36.9	0.67	**11.25**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.6 CLARIANT SAFEWING MPII 1951, LOT DEGE144062, NEAT E-618.

FP-904



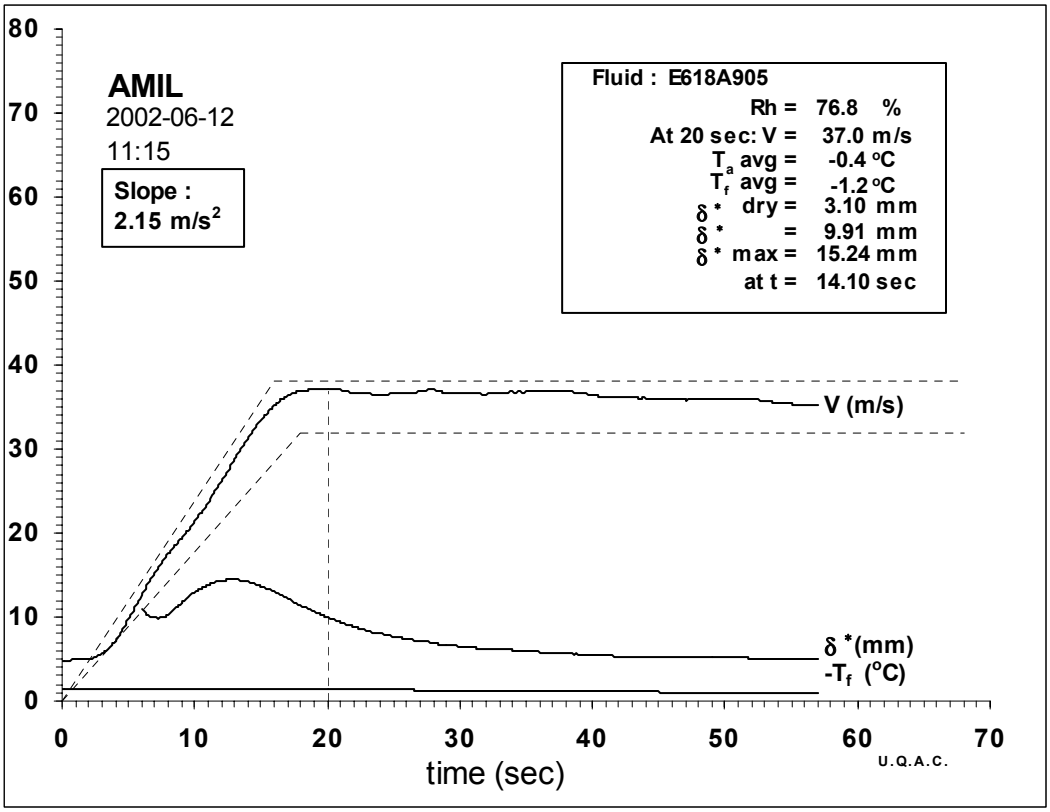
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.4	-0.6	83.0	3.67	37.8	0.61	10.52
20	0.4	-0.6	74.9	3.60	37.5	0.54	9.88
21	0.4	-0.6	81.7	3.60	37.5	0.51	9.46

Averages :

20	0.4	**-0.6**	78.8	3.62	37.6	0.55	**9.91**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



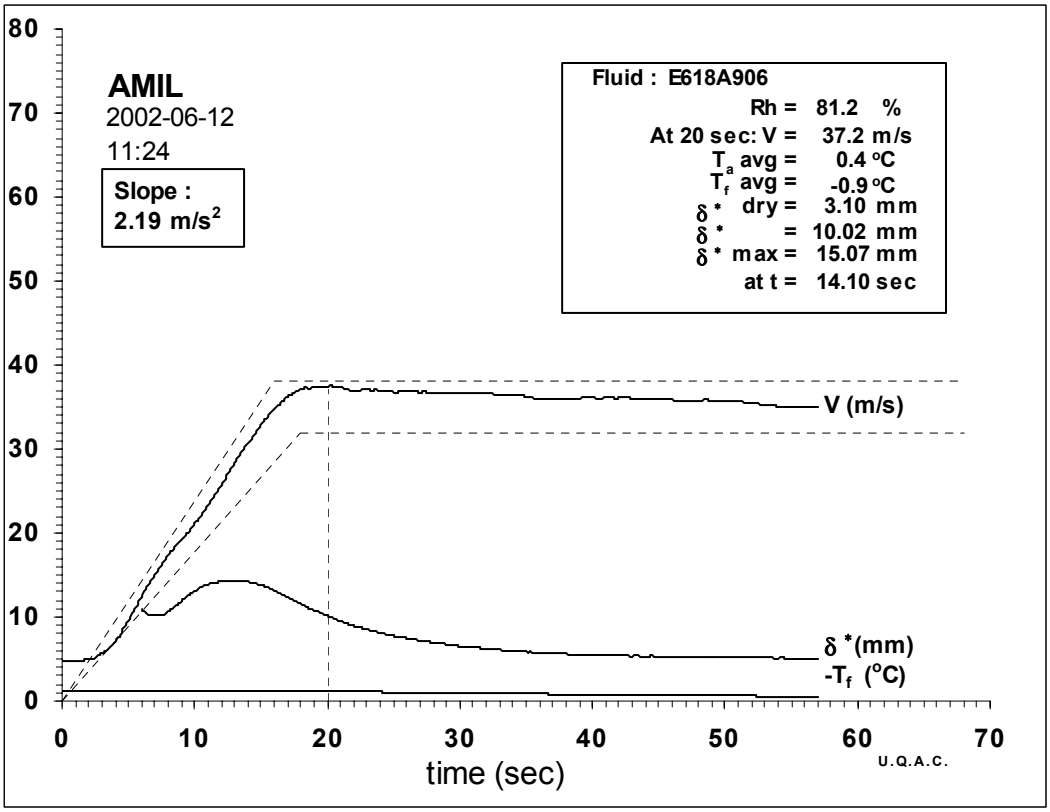
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.7	-1.4	78.2	3.56	37.2	0.59	10.45
20	-0.7	-1.4	71.4	3.49	36.9	0.53	9.95
21	-0.7	-1.4	84.5	3.49	36.9	0.48	9.38

Averages :

20	-0.7	**-1.4**	76.8	3.51	37.0	0.53	**9.91**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



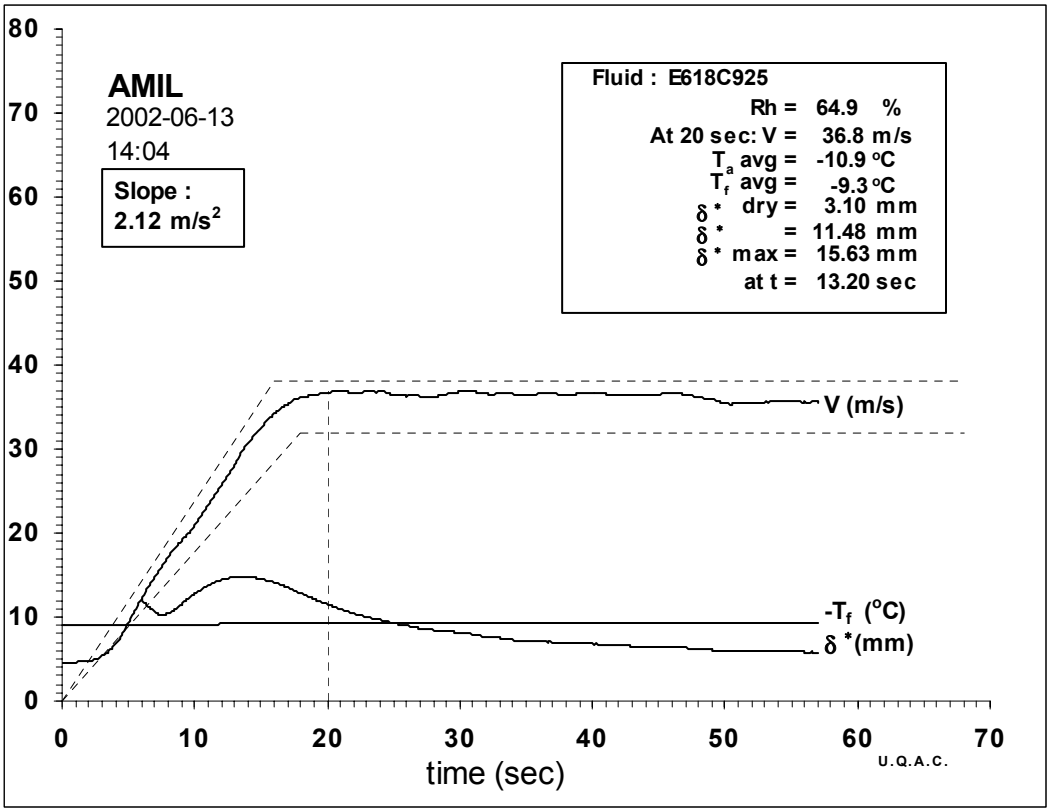
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.2	-1.1	83.6	3.63	37.6	0.61	10.62
20	0.2	-1.1	80.7	3.54	37.2	0.54	9.96
21	0.2	-1.1	80.2	3.46	36.7	0.50	9.64

Averages :

20	0.2	**-1.1**	81.2	3.54	37.2	0.55	**10.02**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



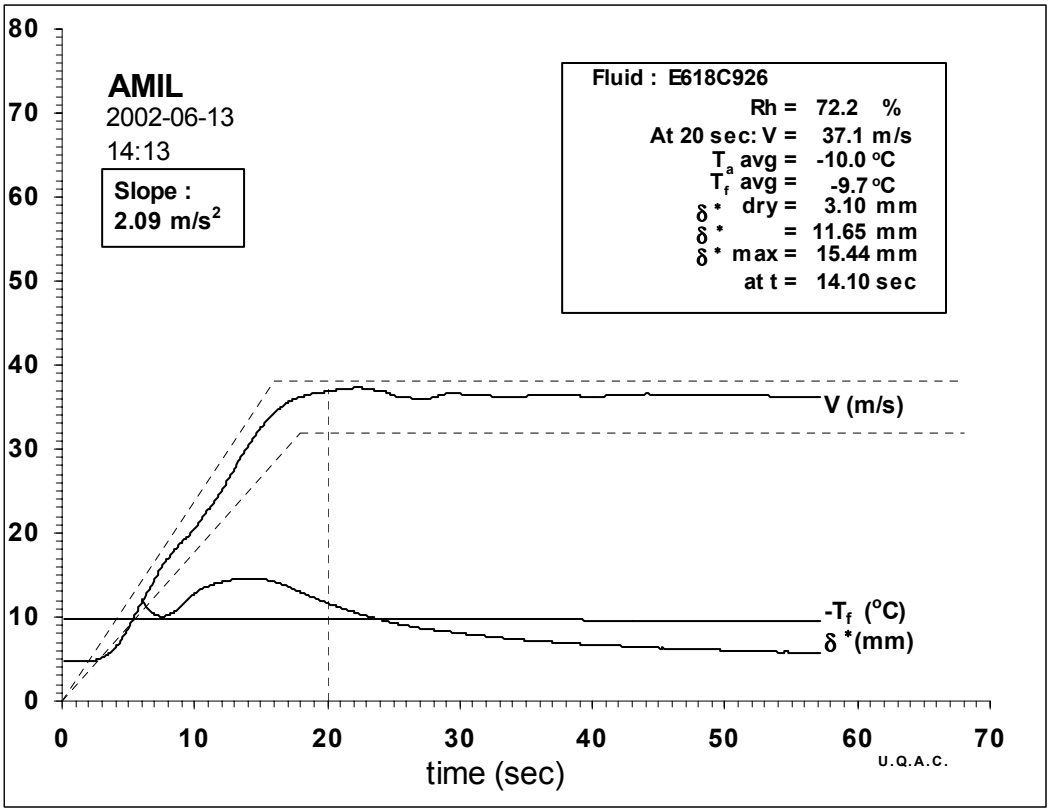
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-11.2	-9.2	63.3	3.89	38.1	0.80	12.07
20	-11.2	-9.2	64.4	3.56	36.5	0.68	11.48
21	-11.2	-9.2	66.8	3.52	36.3	0.63	11.00

Averages :

20	-11.2	**-9.2**	64.9	3.63	36.8	0.69	**11.48**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



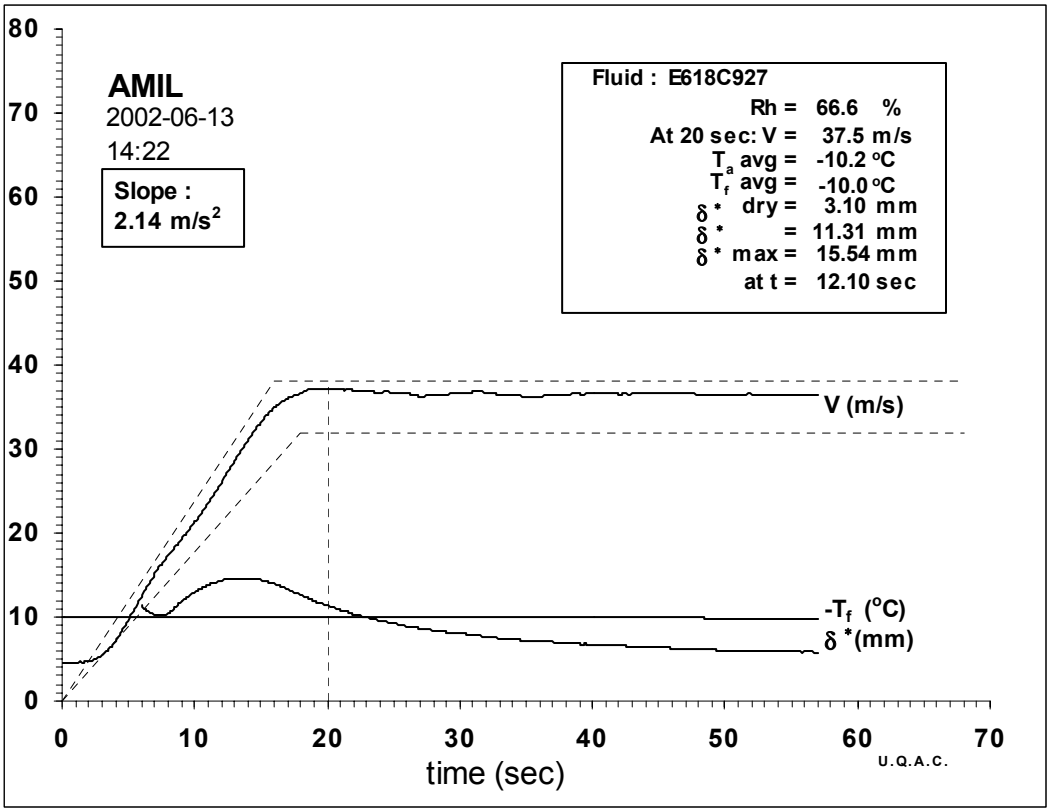
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.2	-9.7	69.7	3.63	36.9	0.74	12.01
20	-10.2	-9.7	73.0	3.63	37.0	0.72	11.75
21	-10.1	-9.7	73.1	3.76	37.6	0.69	11.19

Averages :

20	-10.2	**-9.7**	72.2	3.67	37.1	0.72	**11.65**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



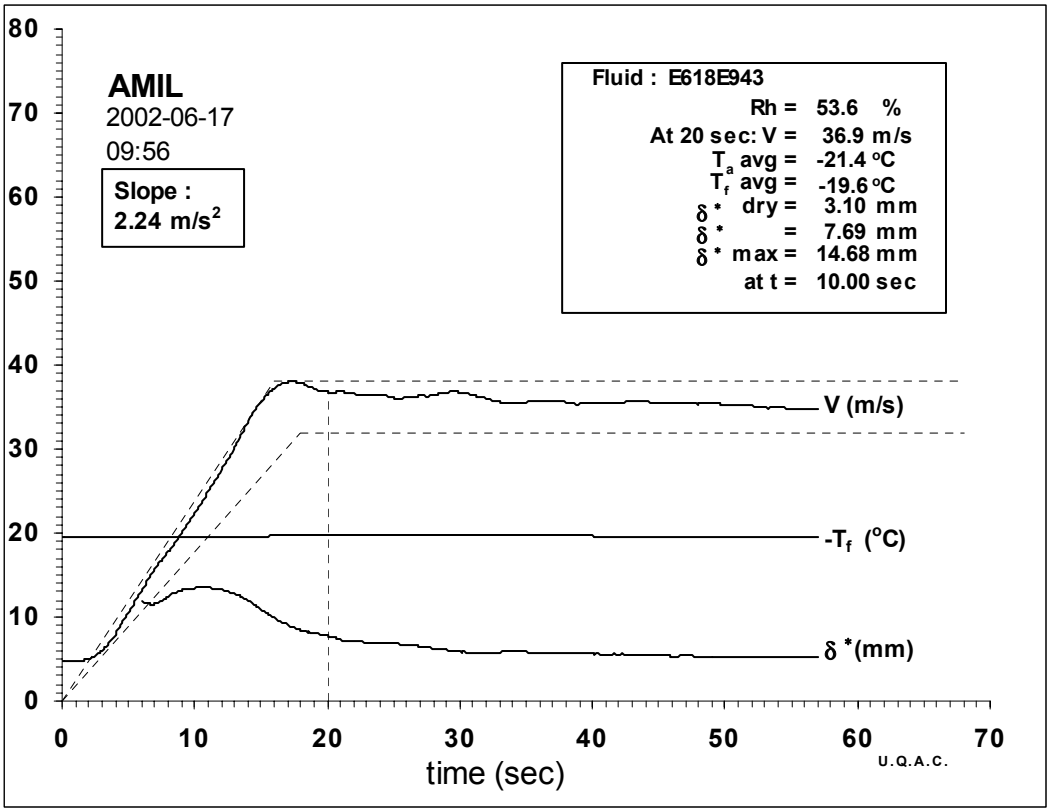
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.4	-10.1	68.5	3.55	36.5	0.70	11.66
20	-10.4	-10.1	66.5	3.85	38.0	0.73	11.47
21	-10.4	-10.1	65.1	3.75	37.5	0.65	10.75

Averages :

20	-10.4	**-10.1**	66.6	3.75	37.5	0.70	**11.31**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



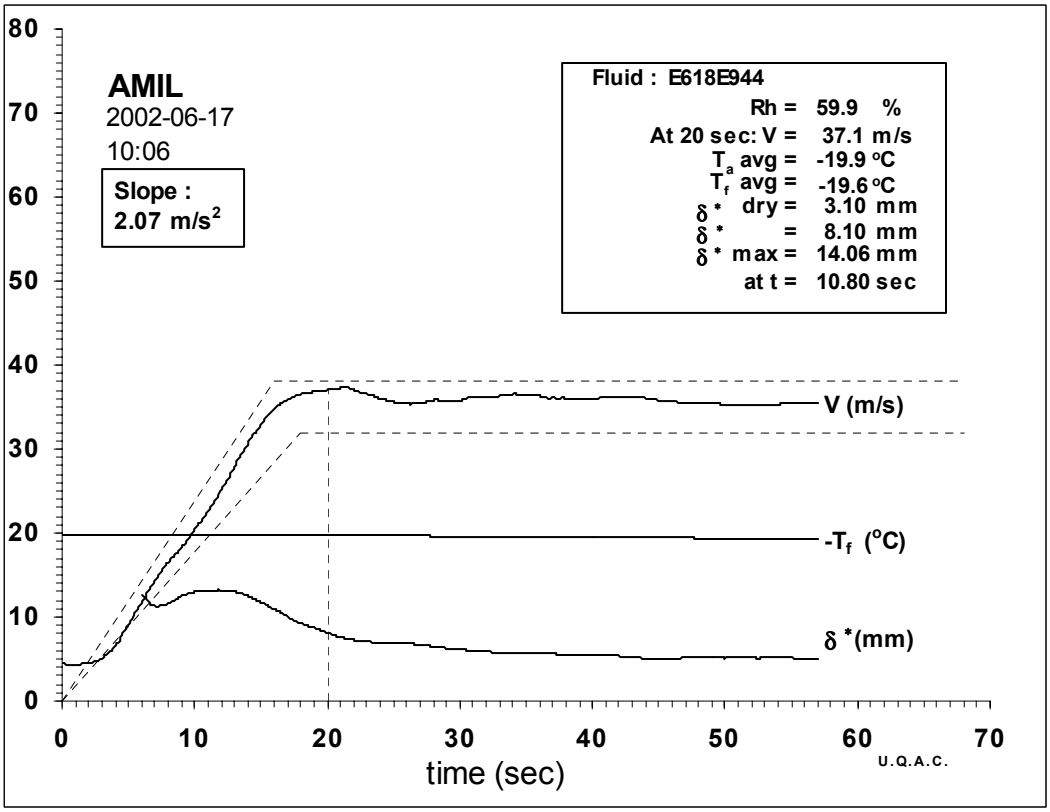
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-21.7	-19.7	52.9	3.96	37.7	0.40	7.79
20	-21.7	-19.6	54.0	3.77	36.8	0.36	7.58
21	-21.7	-19.7	53.3	3.67	36.3	0.37	7.79

Averages :

20	-21.7	**-19.7**	53.6	3.79	36.9	0.38	**7.69**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



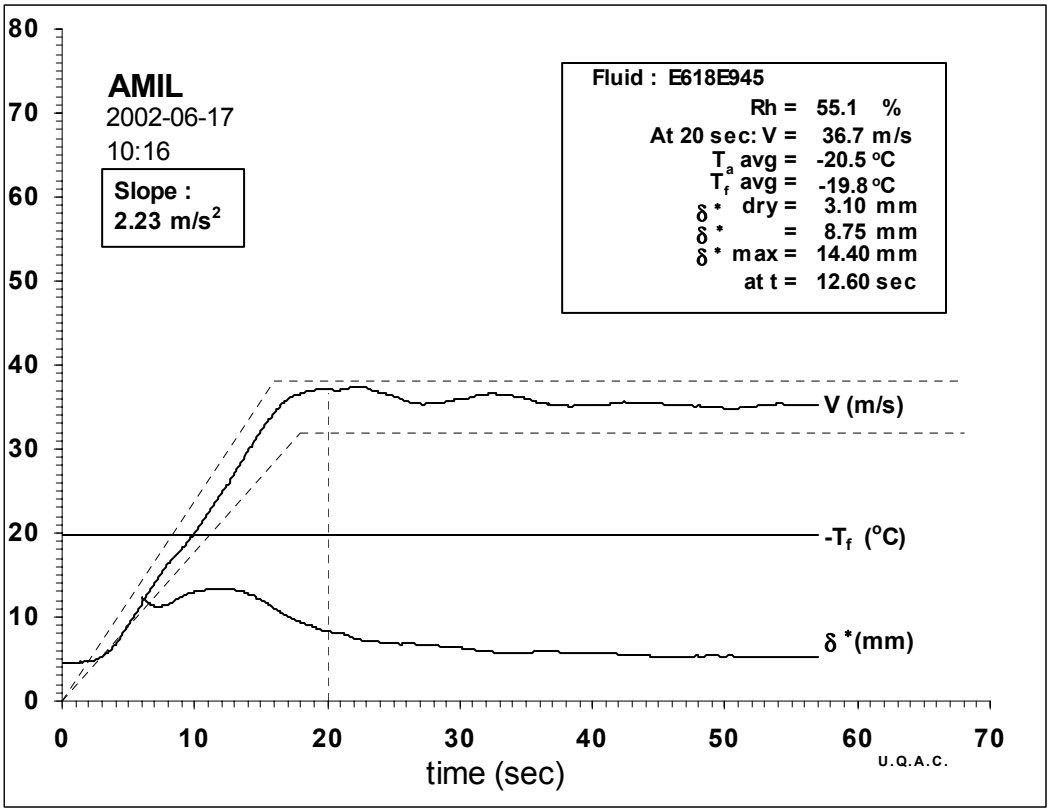
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-20.1	-19.7	61.6	3.81	37.1	0.42	8.19
20	-20.1	-19.7	57.4	3.87	37.4	0.43	8.20
21	-20.1	-19.7	62.6	3.68	36.5	0.38	7.88

Averages :

20	-20.1	**-19.7**	59.9	3.80	37.1	0.41	**8.10**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-20.8	-19.8	53.3	3.52	35.6	0.46	9.09
20	-20.8	-19.8	56.9	3.73	36.7	0.46	8.72
21	-20.8	-19.8	53.5	3.94	37.7	0.47	8.51

Averages :

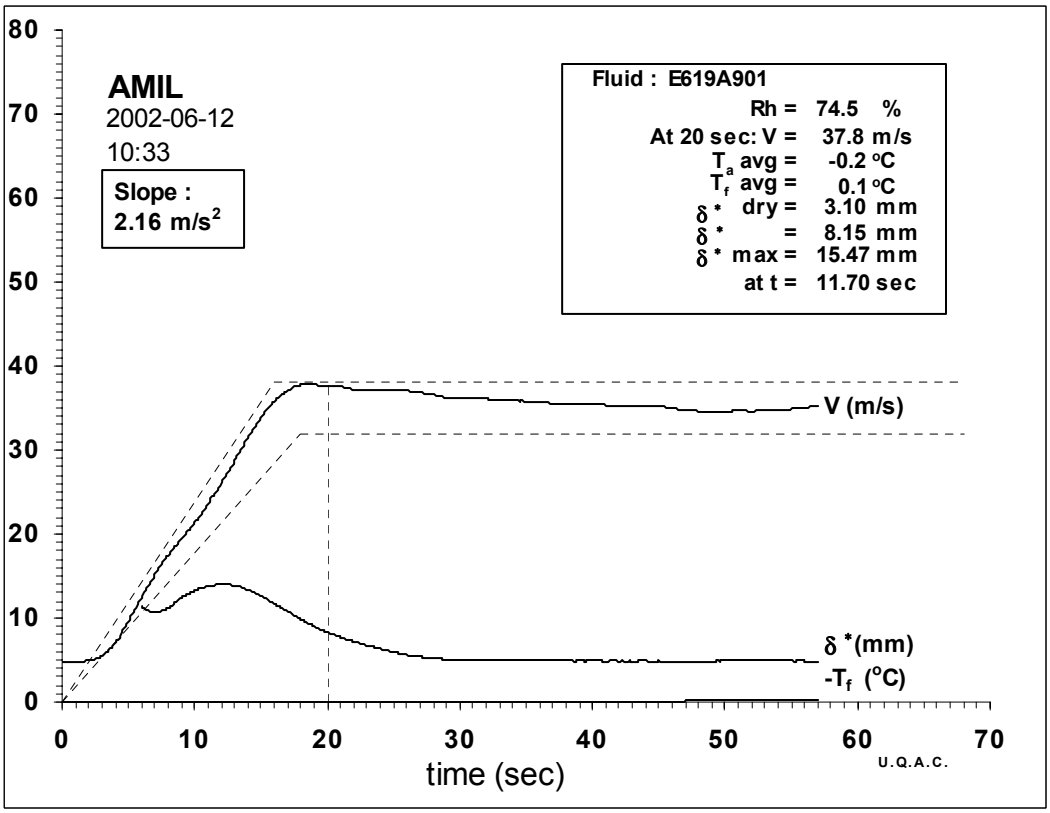
20	-20.8	**-19.8**	55.1	3.74	36.7	0.46	**8.75**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.7 CLARIANT SAFEWING MPII 1951, LOT DEGE144062, 75/25 DILUTION E-619.

FP-901



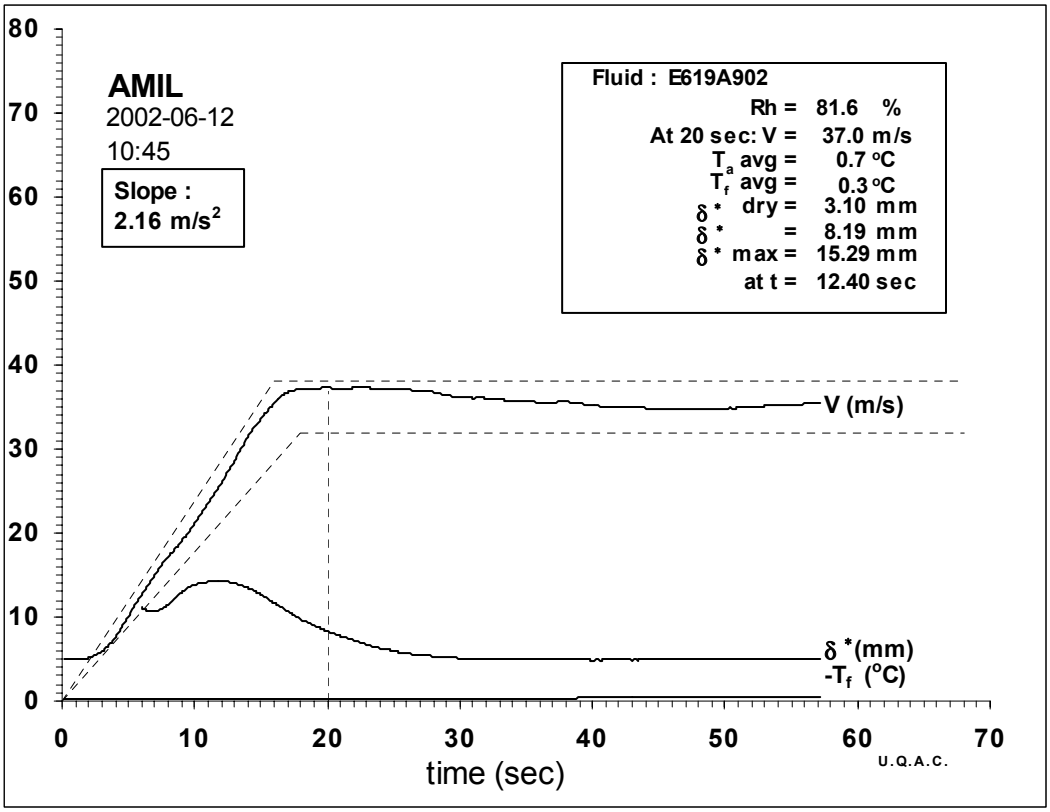
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.4	0.0	68.3	3.71	38.0	0.49	9.11
20	-0.4	0.0	76.5	3.66	37.7	0.39	7.95
21	-0.4	0.0	76.4	3.65	37.7	0.36	7.67

Averages :

20	-0.4	**0.0**	74.5	3.67	37.8	0.40	**8.15**

Test Duct Dimensions :

S_2 = 30570.314 mm² S_3 = 33094.834 mm² B_3 = 301.82 mm C_3 = 822.97 mm



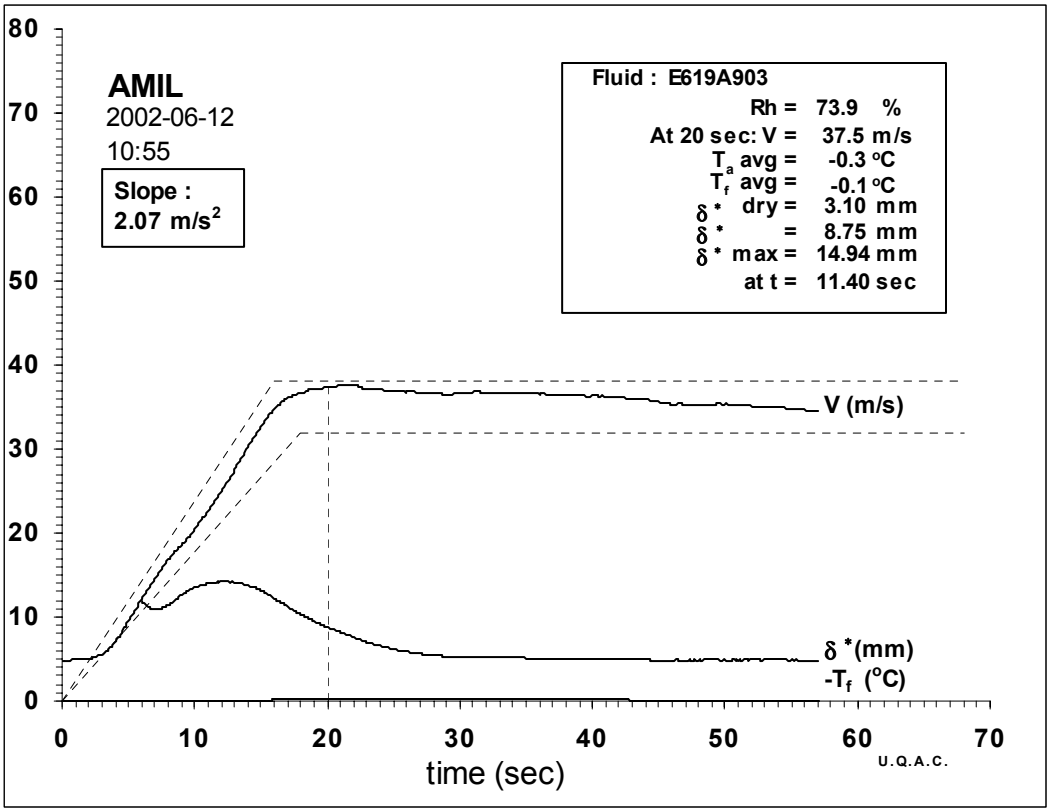
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.6	0.2	80.5	3.49	37.0	0.42	8.58
20	0.6	0.2	82.3	3.46	36.8	0.38	8.20
21	0.6	0.2	81.3	3.55	37.3	0.37	7.86

Averages :

20	0.6	**0.2**	81.6	3.50	37.0	0.39	**8.19**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



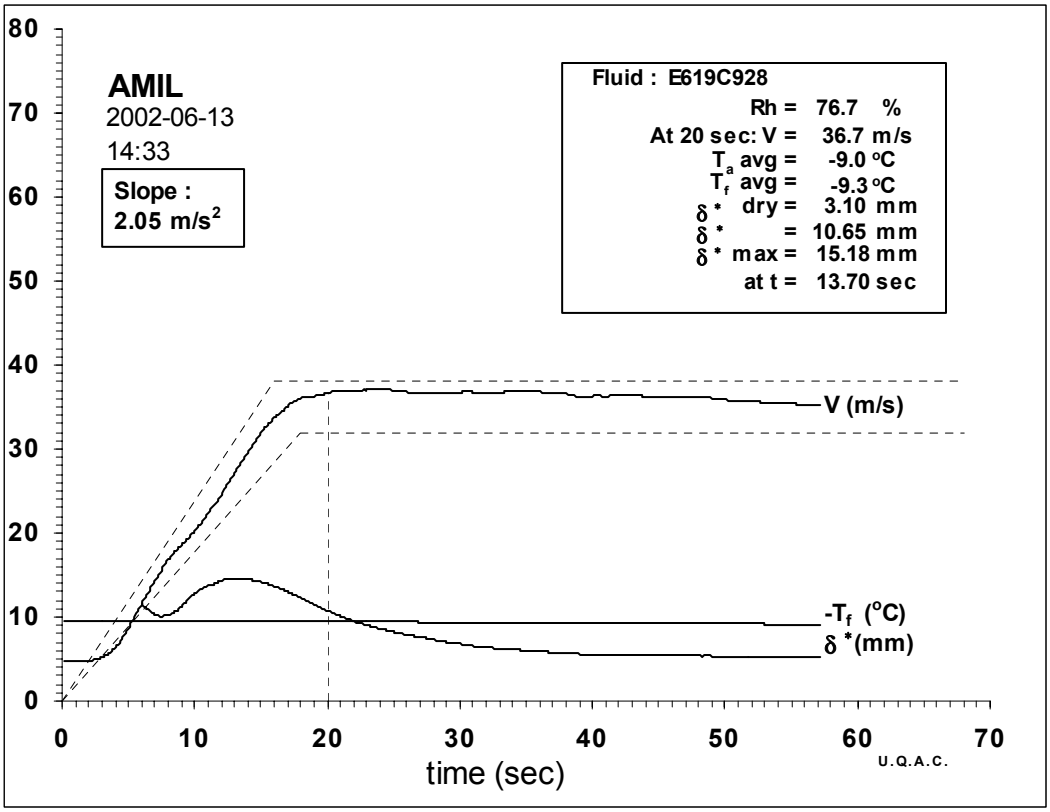
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.6	-0.1	76.5	3.35	36.1	0.44	9.13
20	-0.6	-0.1	72.4	3.59	37.4	0.45	8.85
21	-0.5	-0.1	74.3	3.85	38.7	0.43	8.26

Averages :

20	-0.6	**-0.1**	73.9	3.61	37.5	0.45	**8.75**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



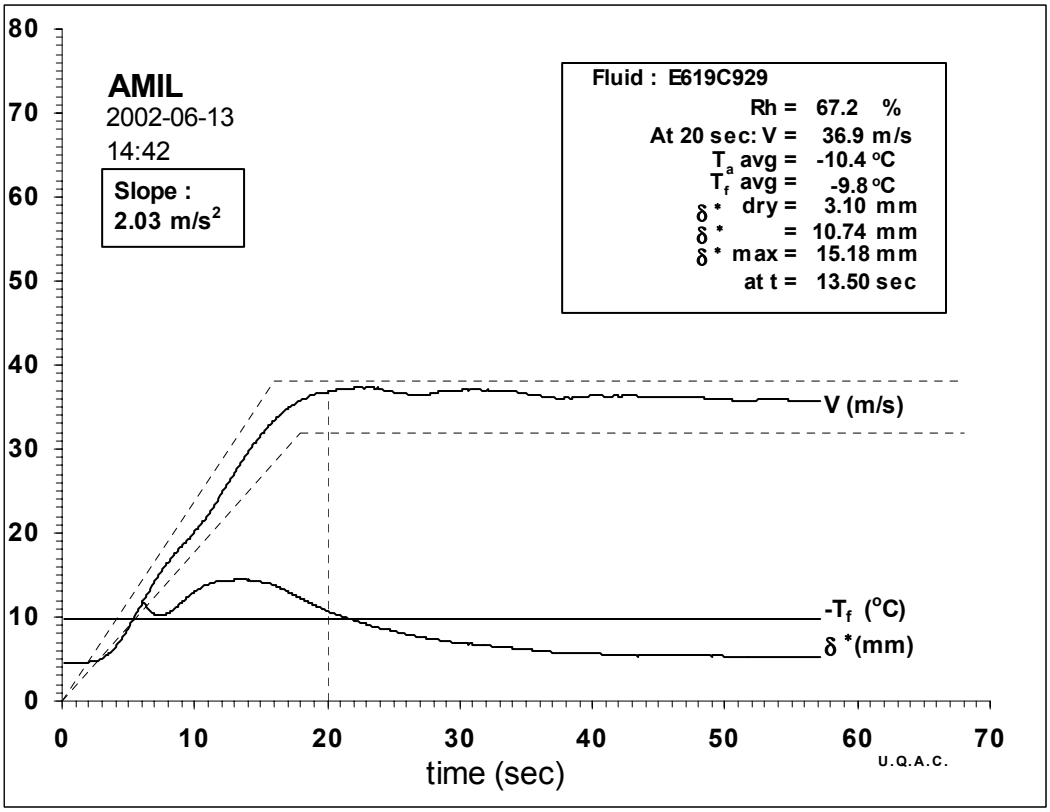
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-9.2	-9.5	72.5	3.60	36.8	0.64	10.98
20	-9.2	-9.5	78.5	3.57	36.7	0.62	10.79
21	-9.2	-9.4	77.1	3.54	36.6	0.56	10.15

Averages :

20	-9.2	**-9.5**	76.7	3.57	36.7	0.61	**10.65**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



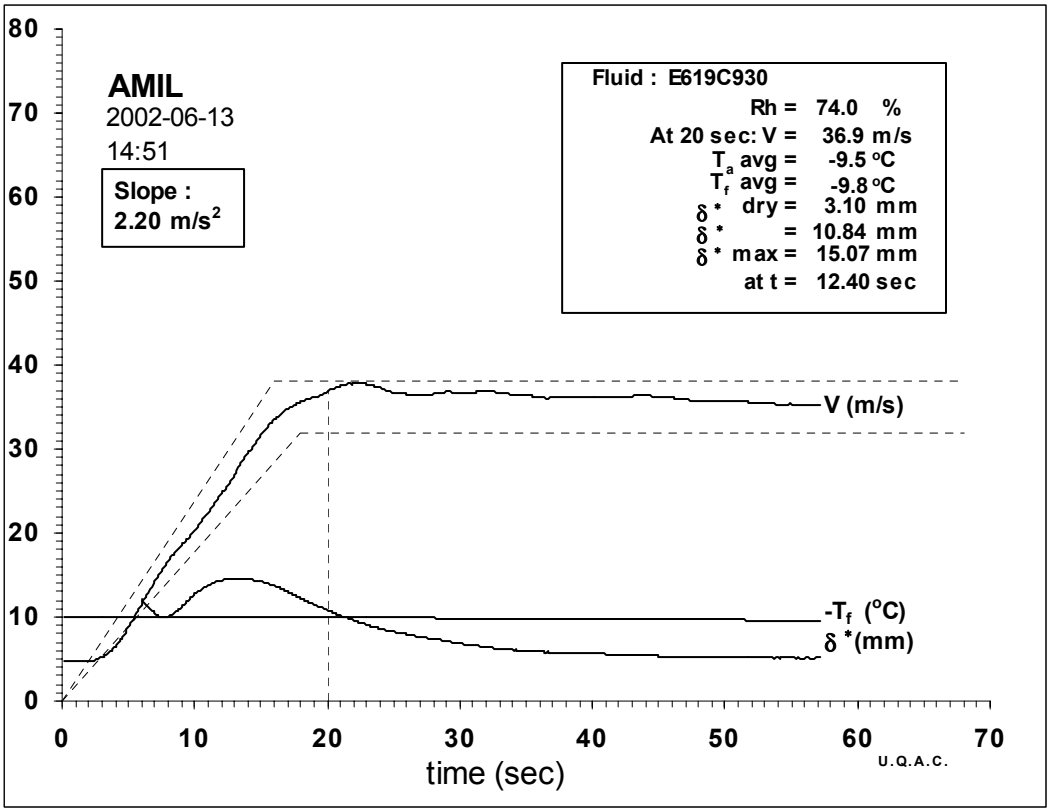
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.6	-9.8	67.0	3.62	36.8	0.67	11.29
20	-10.6	-9.8	67.6	3.60	36.8	0.62	10.76
21	-10.6	-9.8	66.6	3.71	37.3	0.59	10.24

Averages :

20	-10.6	**-9.8**	67.2	3.64	36.9	0.63	**10.74**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



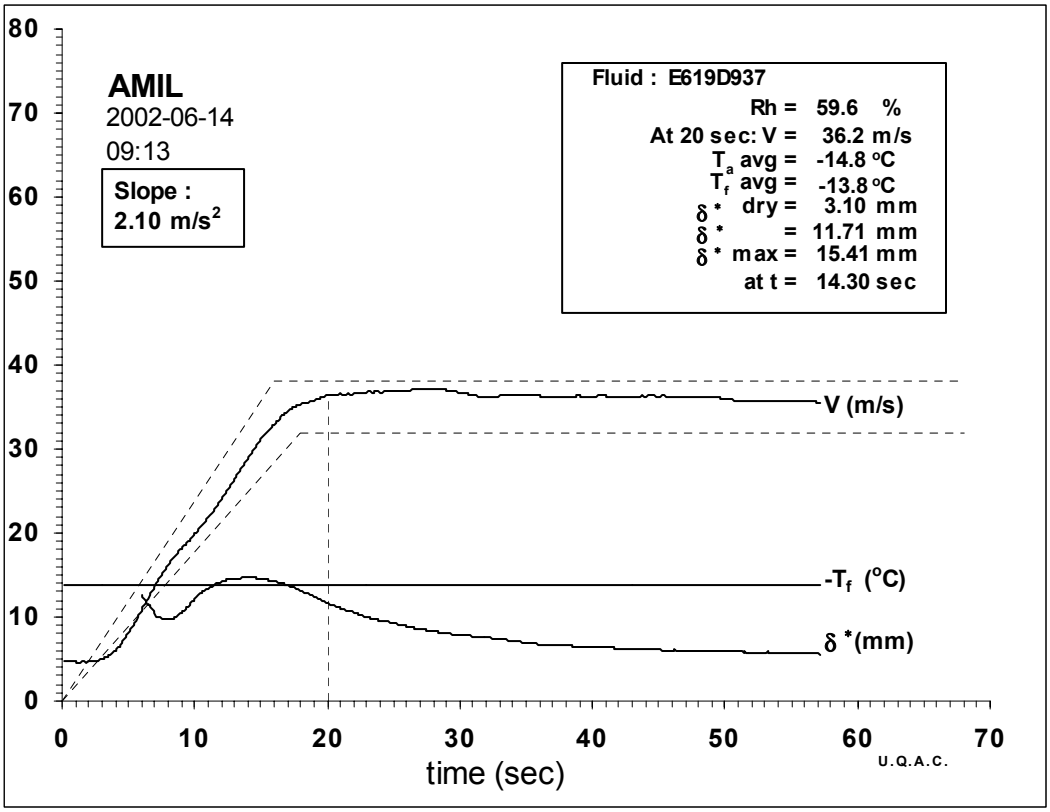
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-9.7	-10.0	76.7	3.43	35.9	0.64	11.27
20	-9.7	-10.0	73.5	3.66	37.1	0.64	10.82
21	-9.7	-10.0	72.5	3.70	37.3	0.62	10.52

Averages :

20	-9.7	**-10.0**	74.0	3.61	36.9	0.63	**10.84**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



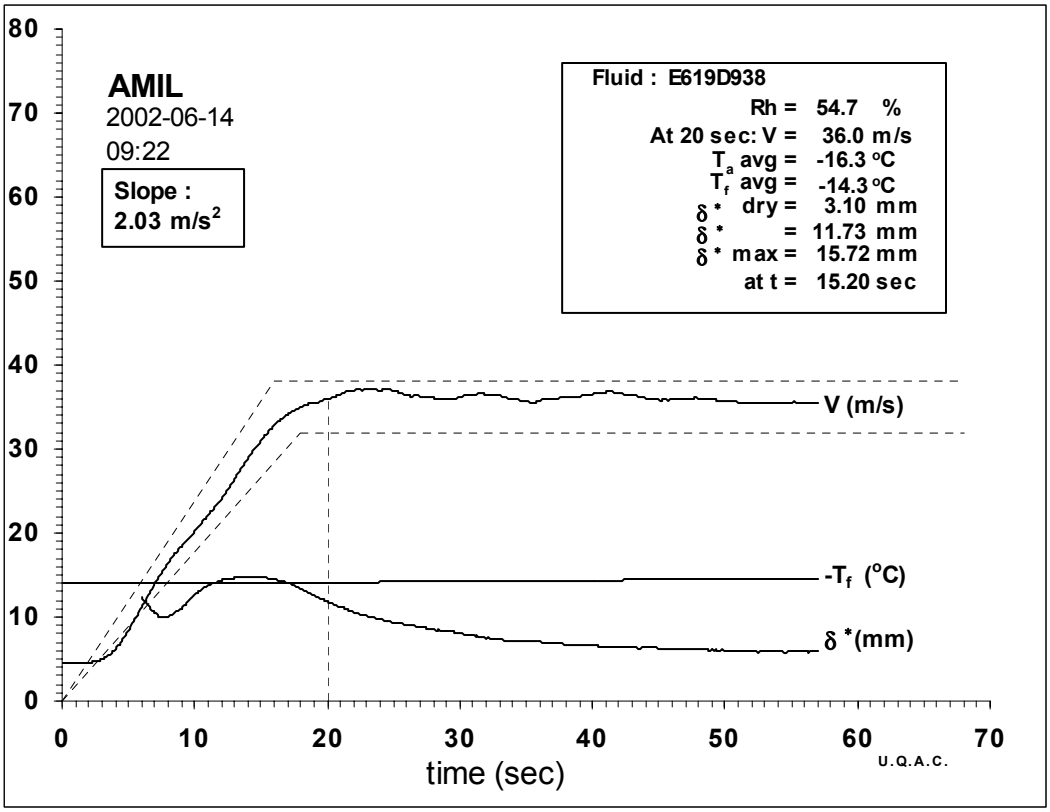
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-15.1	-13.8	59.6	3.54	36.1	0.75	12.25
20	-15.0	-13.9	59.4	3.49	35.9	0.69	11.78
21	-15.0	-13.9	59.9	3.67	36.8	0.67	11.13

Averages :

20	-15.0	**-13.8**	59.6	3.56	36.2	0.70	**11.71**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



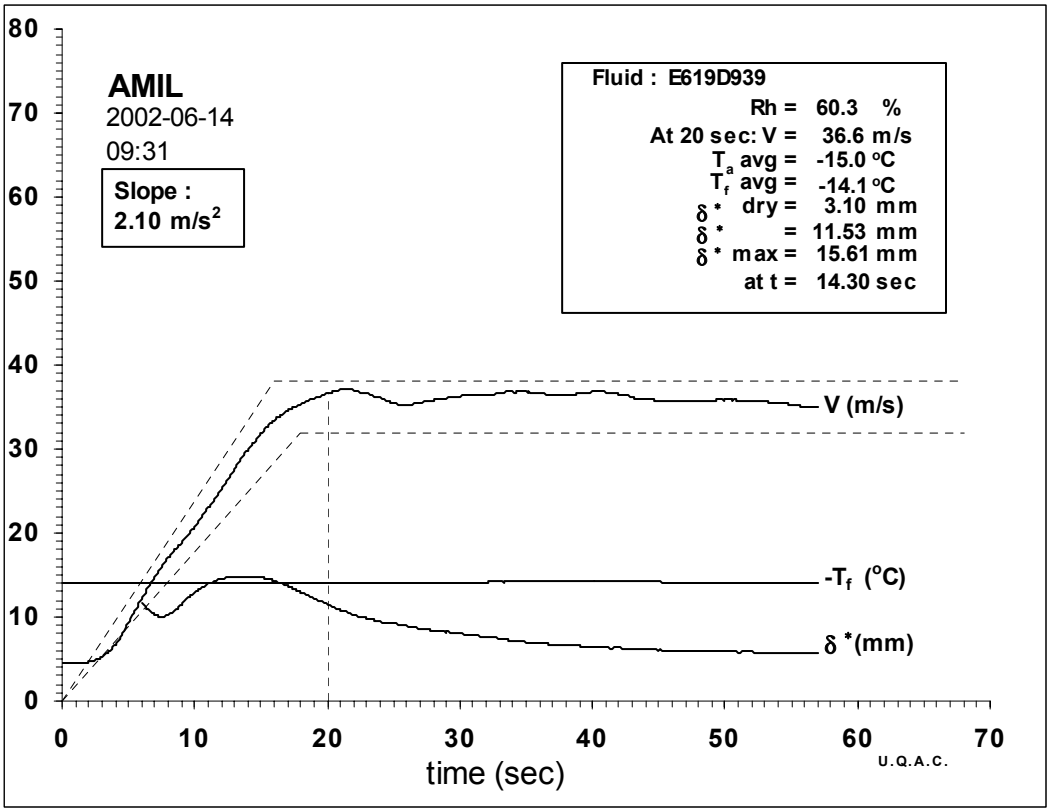
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-16.7	-14.2	54.0	3.42	35.4	0.73	12.39
20	-16.7	-14.1	54.9	3.60	36.3	0.71	11.70
21	-16.7	-14.1	55.0	3.51	35.9	0.65	11.22

Averages :

20	-16.7	**-14.1**	54.7	3.53	36.0	0.70	**11.73**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-15.3	-14.1	59.1	3.53	36.1	0.70	11.81
20	-15.3	-14.1	59.0	3.66	36.7	0.72	11.67
21	-15.3	-14.1	63.4	3.69	36.9	0.67	11.07

Averages :

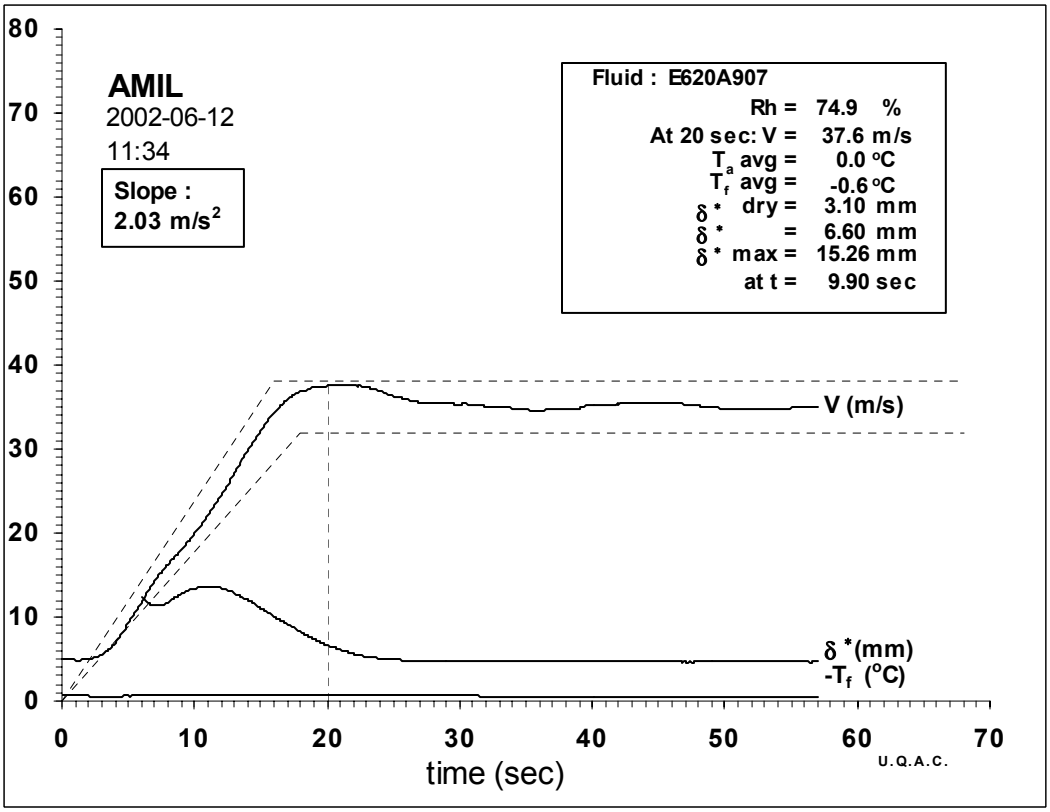
20	-15.3	**-14.1**	60.3	3.64	36.6	0.70	**11.53**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.8 CLARIANT SAFEWING MPII 1951, LOT DEGE144062, 50/50 DILUTION E-620.

FP-907



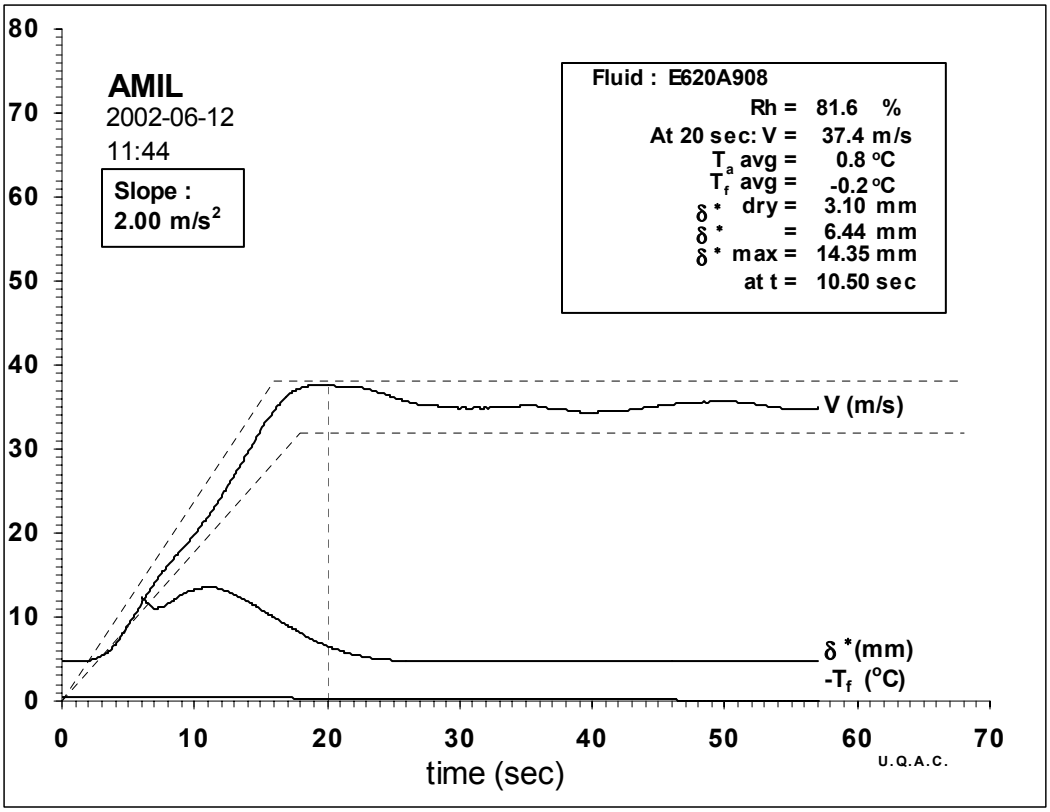
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.2	-0.6	71.6	3.68	37.9	0.34	7.37
20	-0.2	-0.6	75.9	3.57	37.3	0.26	6.45
21	-0.2	-0.6	75.9	3.65	37.7	0.24	6.21

Averages :

20	-0.2	**-0.6**	74.9	3.62	37.6	0.27	**6.60**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



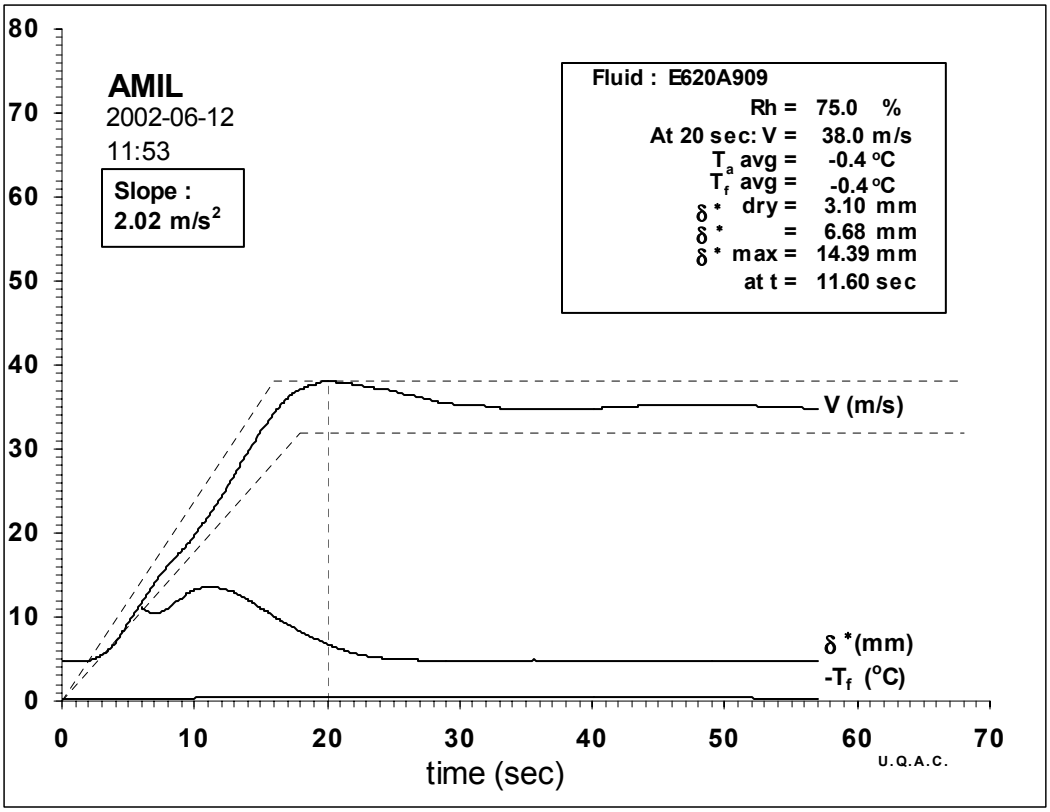
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.8	-0.4	80.9	3.61	37.6	0.31	7.13
20	0.7	-0.3	82.1	3.58	37.4	0.25	6.39
21	0.7	-0.3	81.1	3.55	37.3	0.22	5.95

Averages :

20	0.7	**-0.3**	81.6	3.58	37.4	0.26	**6.44**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



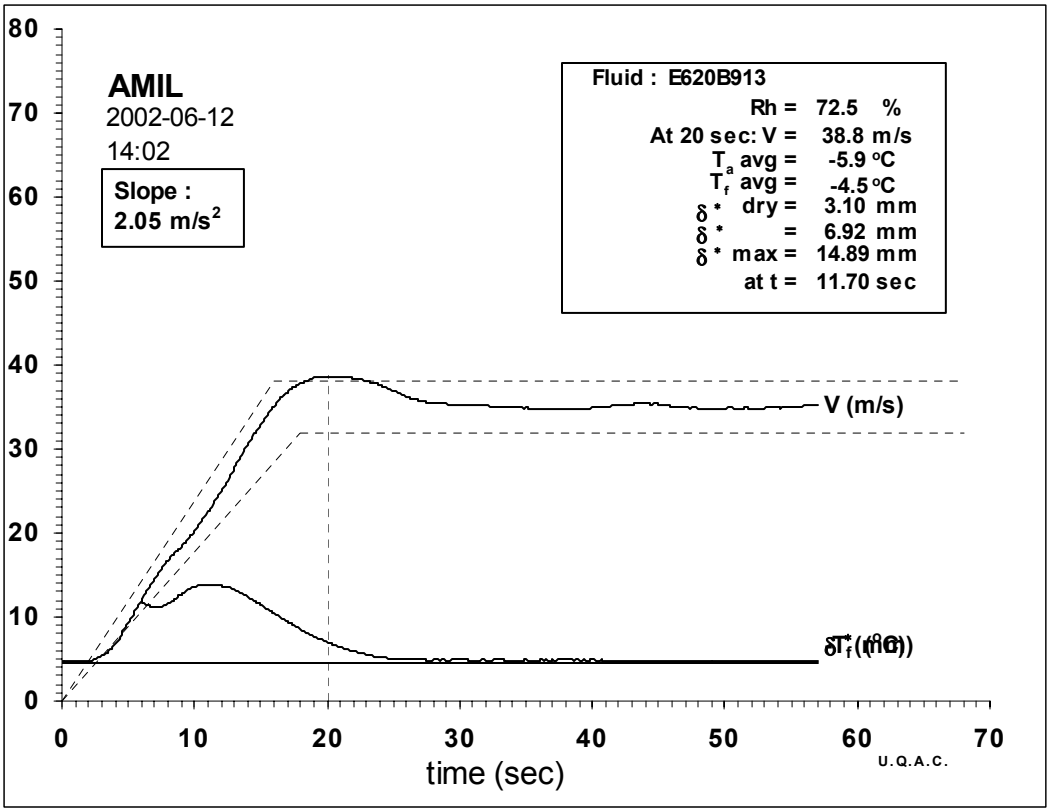
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.6	-0.4	75.5	3.73	38.1	0.35	7.50
20	-0.6	-0.4	75.0	3.71	38.0	0.28	6.62
21	-0.6	-0.4	74.7	3.68	37.8	0.24	6.11

Averages :

20	-0.6	**-0.4**	75.0	3.71	38.0	0.29	**6.68**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



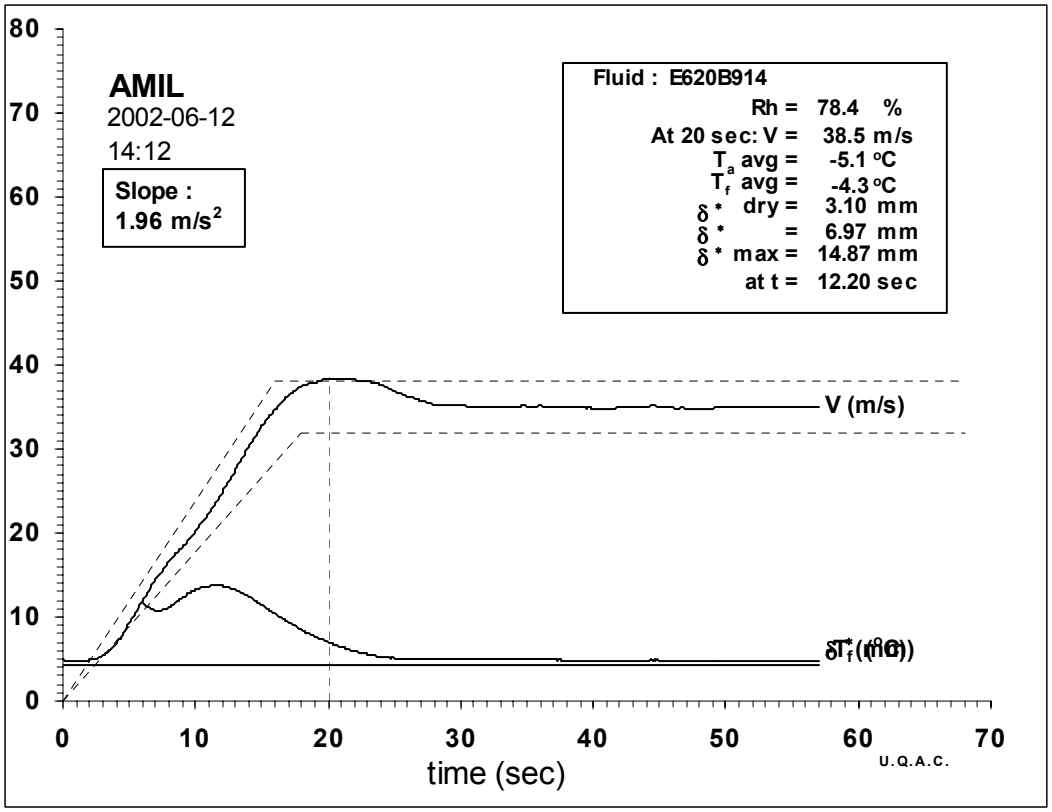
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-6.1	-4.4	73.4	3.96	38.9	0.37	7.43
20	-6.1	-4.5	72.8	3.90	38.6	0.32	6.93
21	-6.1	-4.5	71.2	3.98	39.0	0.29	6.49

Averages :

20	-6.1	**-4.5**	72.5	3.94	38.8	0.32	**6.92**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



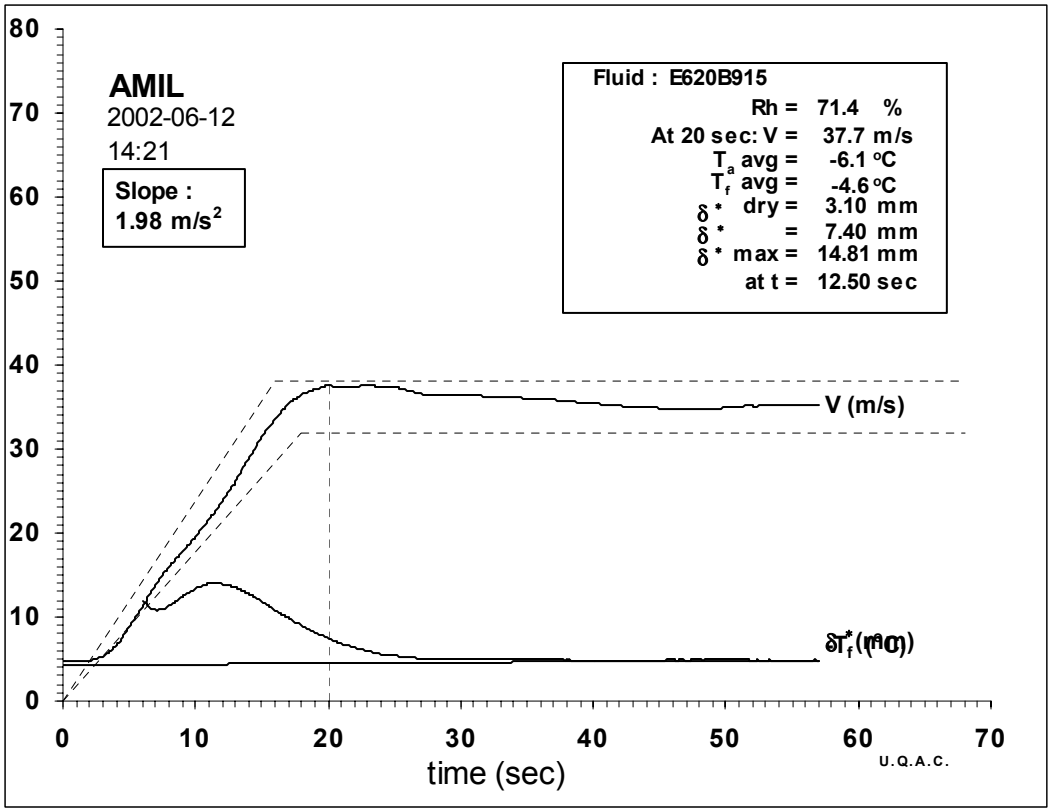
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-5.2	-4.3	79.8	3.81	38.2	0.38	7.70
20	-5.2	-4.3	78.7	3.94	38.8	0.32	6.92
21	-5.2	-4.3	76.9	3.78	38.0	0.27	6.45

Averages :

20	-5.2	**-4.3**	78.4	3.86	38.5	0.32	**6.97**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



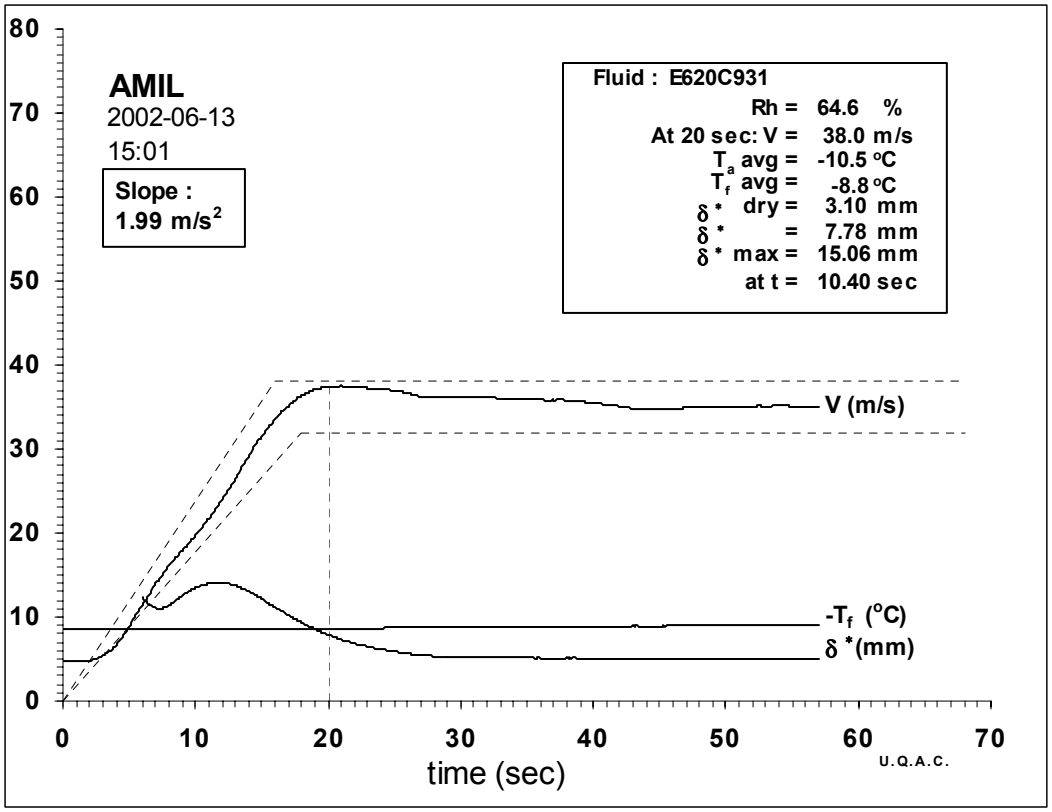
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-6.4	-4.4	70.7	3.67	37.4	0.36	7.63
20	-6.4	-4.5	71.9	3.78	37.9	0.36	7.49
21	-6.4	-4.5	71.0	3.71	37.6	0.31	7.05

Averages :

20	-6.4	**-4.5**	71.4	3.73	37.7	0.35	**7.40**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



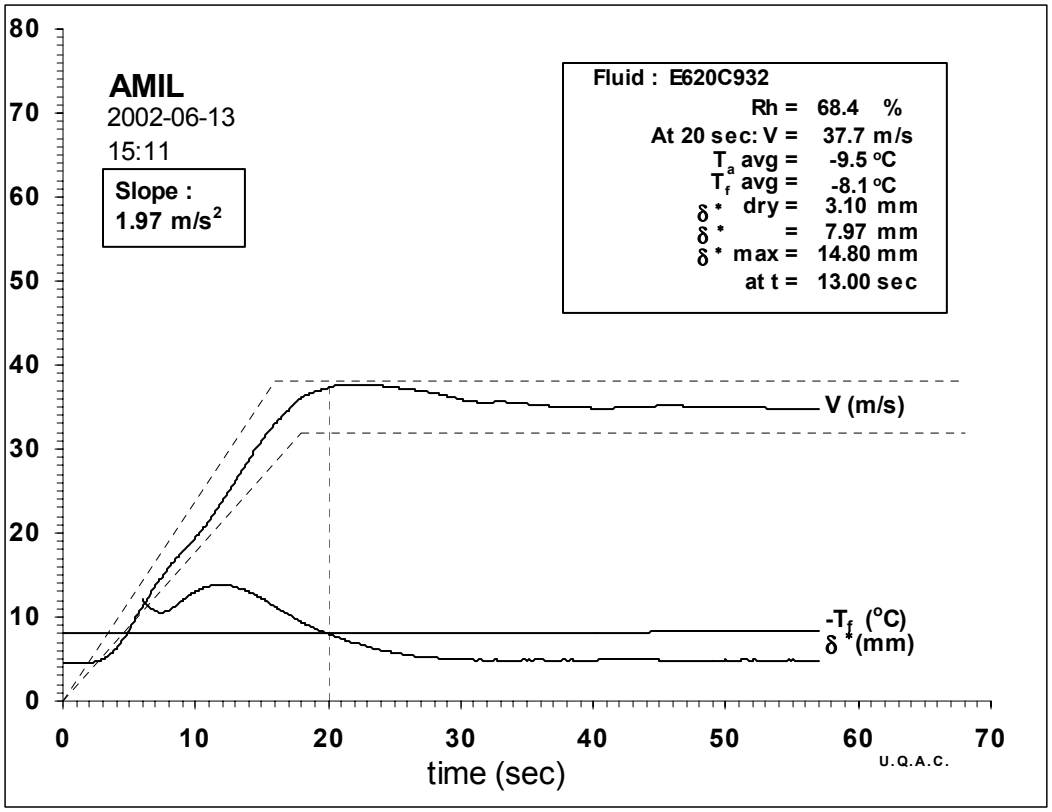
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.8	-8.6	63.1	3.81	37.8	0.43	8.29
20	-10.7	-8.6	65.0	3.83	37.9	0.40	7.88
21	-10.8	-8.6	65.2	3.90	38.2	0.34	7.20

Averages :

20	-10.7	**-8.6**	64.6	3.85	38.0	0.39	**7.78**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



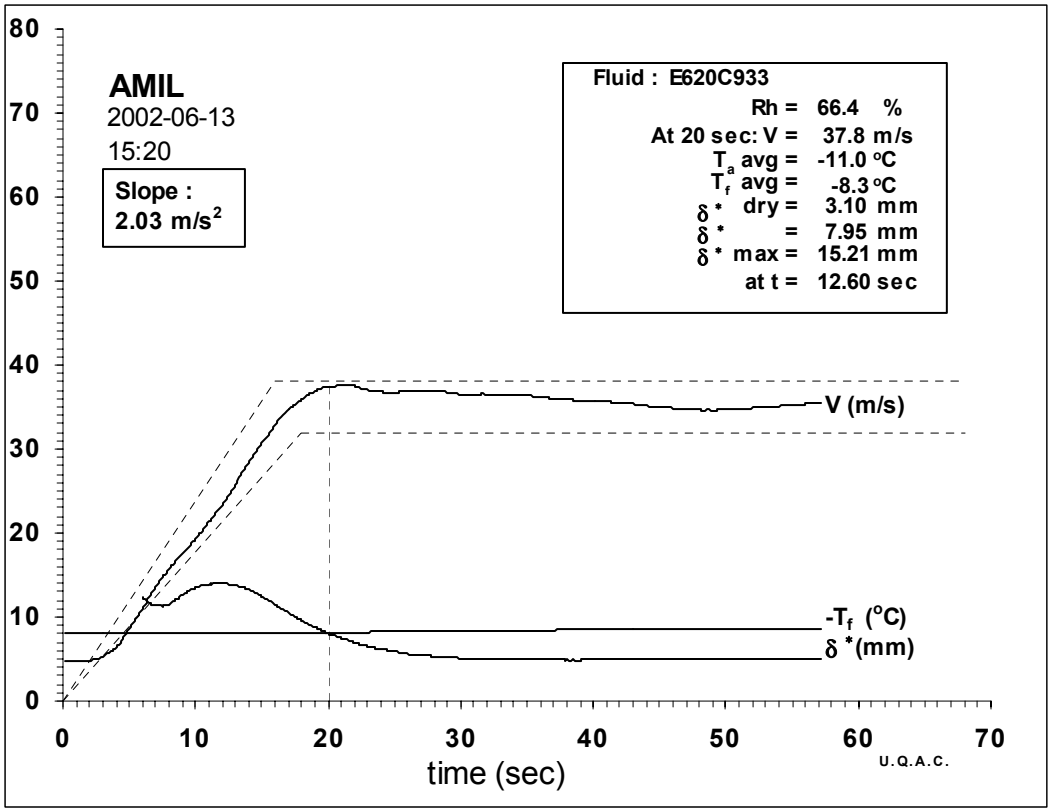
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ* mm
19	-9.7	-8.0	70.0	3.77	37.7	0.47	8.75
20	-9.6	-8.0	67.8	3.85	38.1	0.39	7.78
21	-9.6	-8.0	68.2	3.63	36.9	0.36	7.65

Averages :

20	-9.6	**-8.0**	68.4	3.77	37.7	0.40	**7.97**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-8.1	65.9	3.67	37.0	0.43	8.49
20	-11.3	-8.1	64.4	3.89	38.2	0.41	7.98
21	-11.3	-8.1	70.1	3.82	37.8	0.36	7.45

Averages :

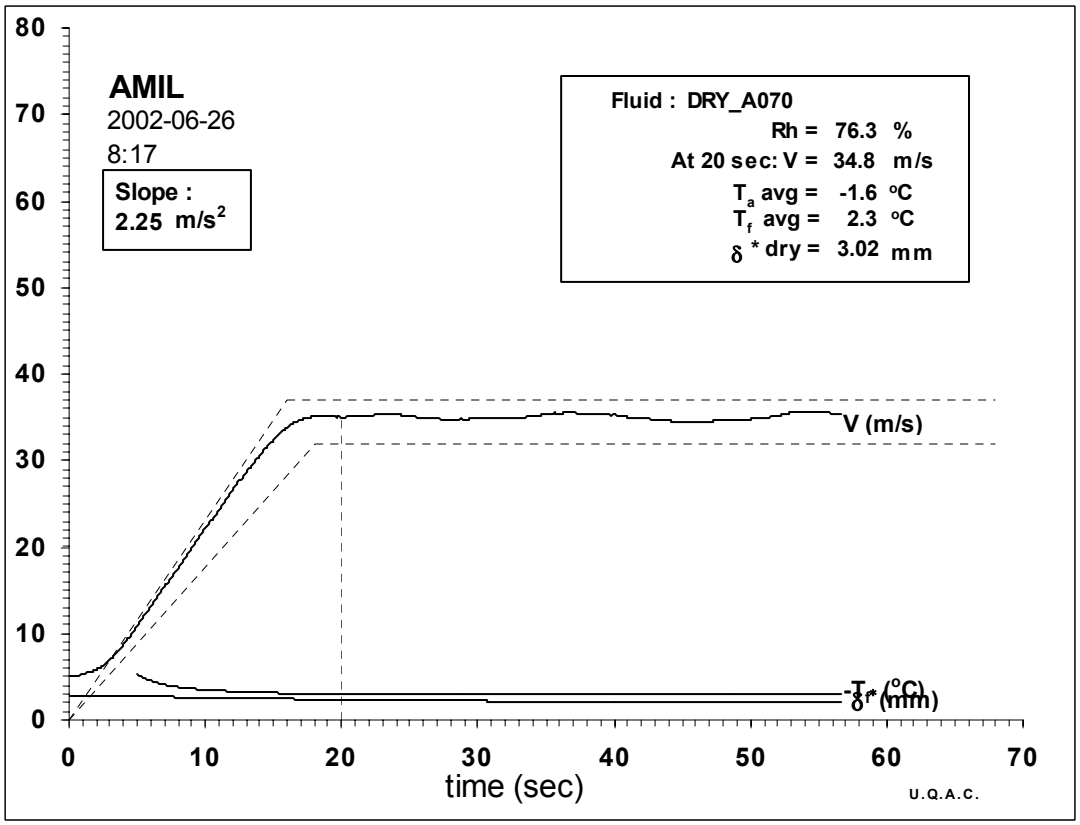
20	-11.3	**-8.1**	66.4	3.82	37.8	0.40	**7.95**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.9 DRY RUNS, TYPE IV FLUID SERIES.

FPD-070



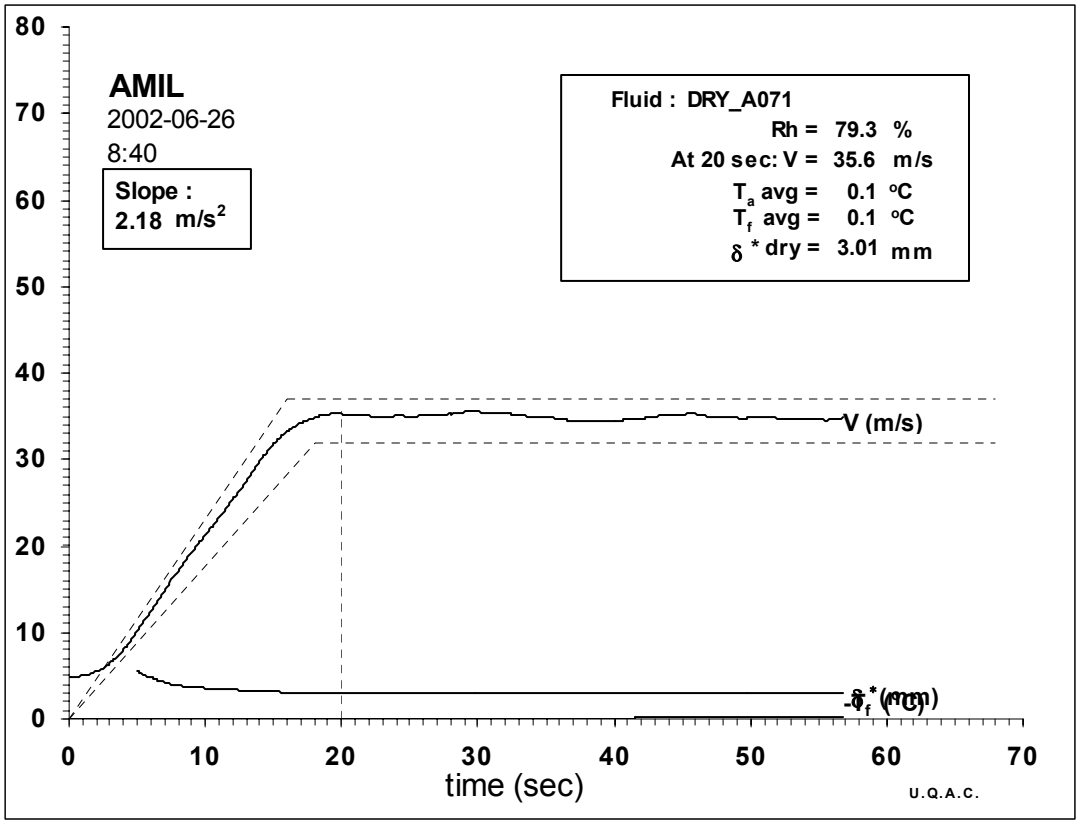
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-1.8	2.4	75.8	3.13	34.9	-0.02	2.98
20	-1.7	2.3	74.1	3.08	34.5	-0.01	3.01
21	-1.8	2.3	80.3	3.16	35.0	0.00	3.08

Averages:

20	-1.8	**2.3**	76.3	3.11	34.8	-0.01	**3.02**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



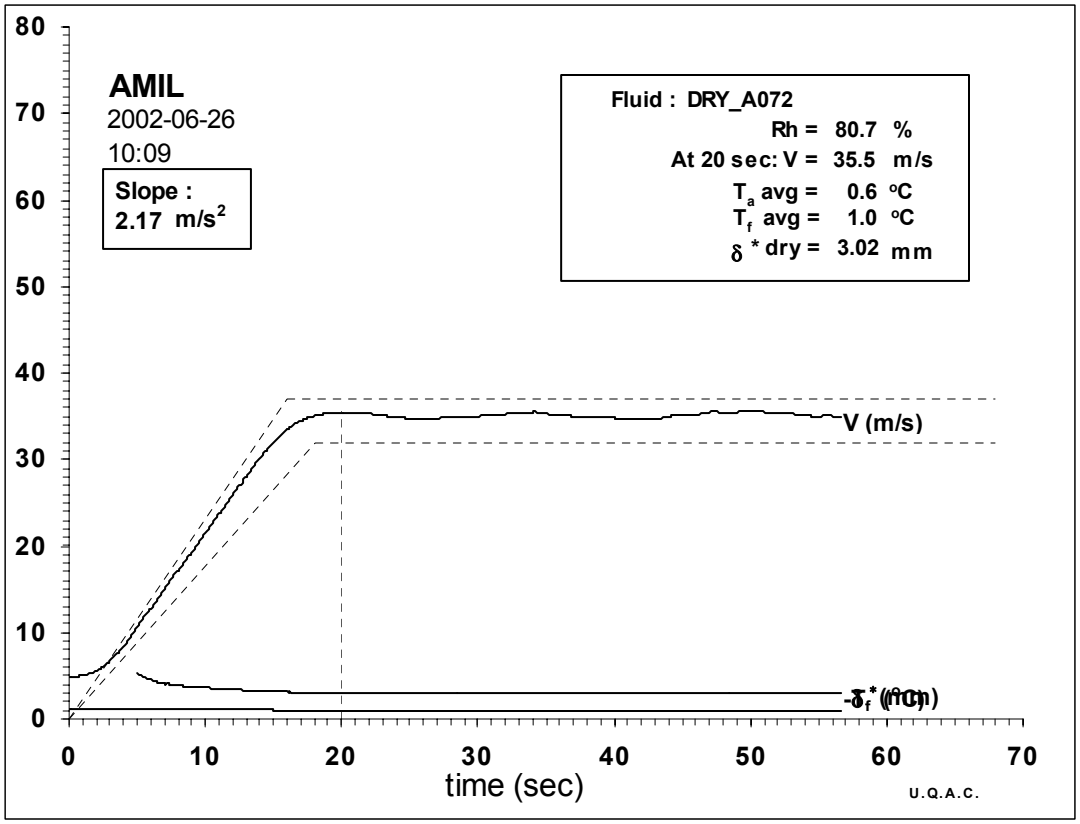
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	0.1	0.0	79.7	3.19	35.3	-0.01	3.02
20	0.1	0.0	78.0	3.28	35.8	0.00	3.05
21	0.1	0.0	81.3	3.22	35.5	-0.02	2.94

Averages:

20	0.1	**0.0**	79.3	3.24	35.6	-0.01	**3.01**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



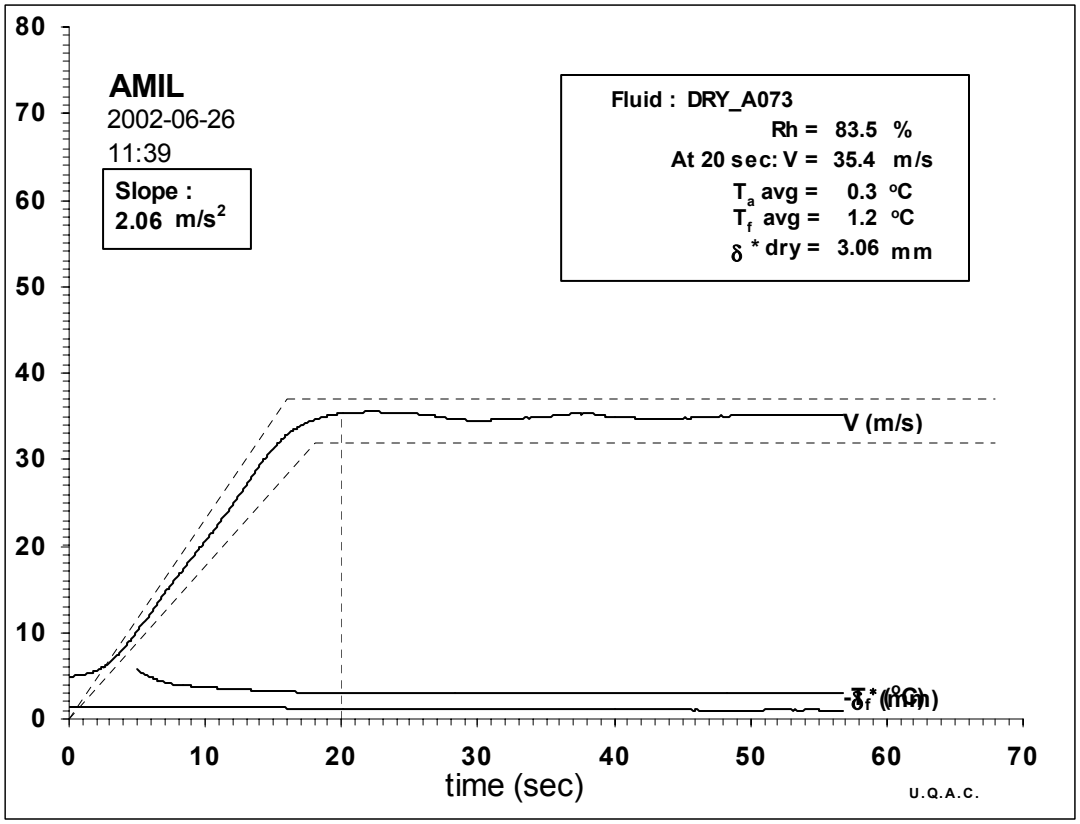
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	0.4	1.0	80.9	3.28	35.8	-0.01	3.01
20	0.4	1.0	81.2	3.18	35.3	-0.01	3.03
21	0.4	1.0	79.7	3.23	35.5	-0.01	3.00

Averages:

20	0.4	**1.0**	80.7	3.22	35.5	-0.01	**3.02**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



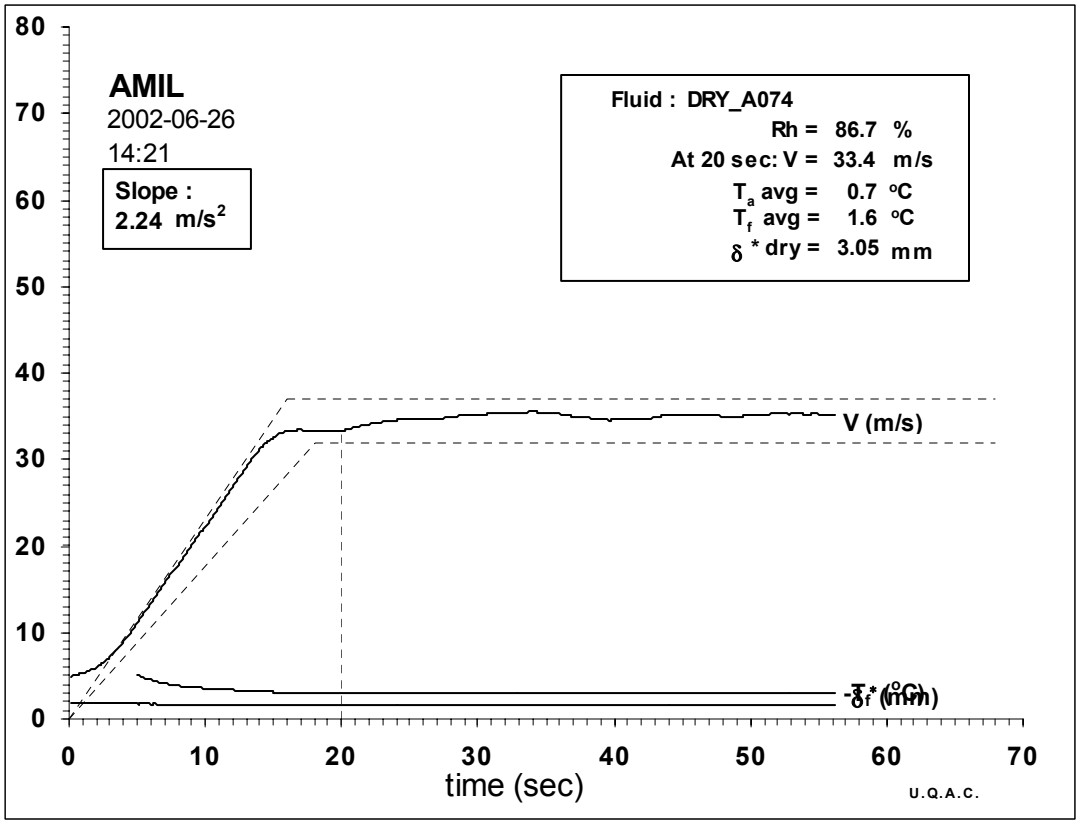
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	0.1	1.2	84.7	3.20	35.3	0.00	3.07
20	0.1	1.2	83.5	3.20	35.4	0.00	3.06
21	0.1	1.2	82.7	3.26	35.7	0.00	3.06

Averages:

20	0.1	**1.2**	83.5	3.22	35.4	0.00	**3.06**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



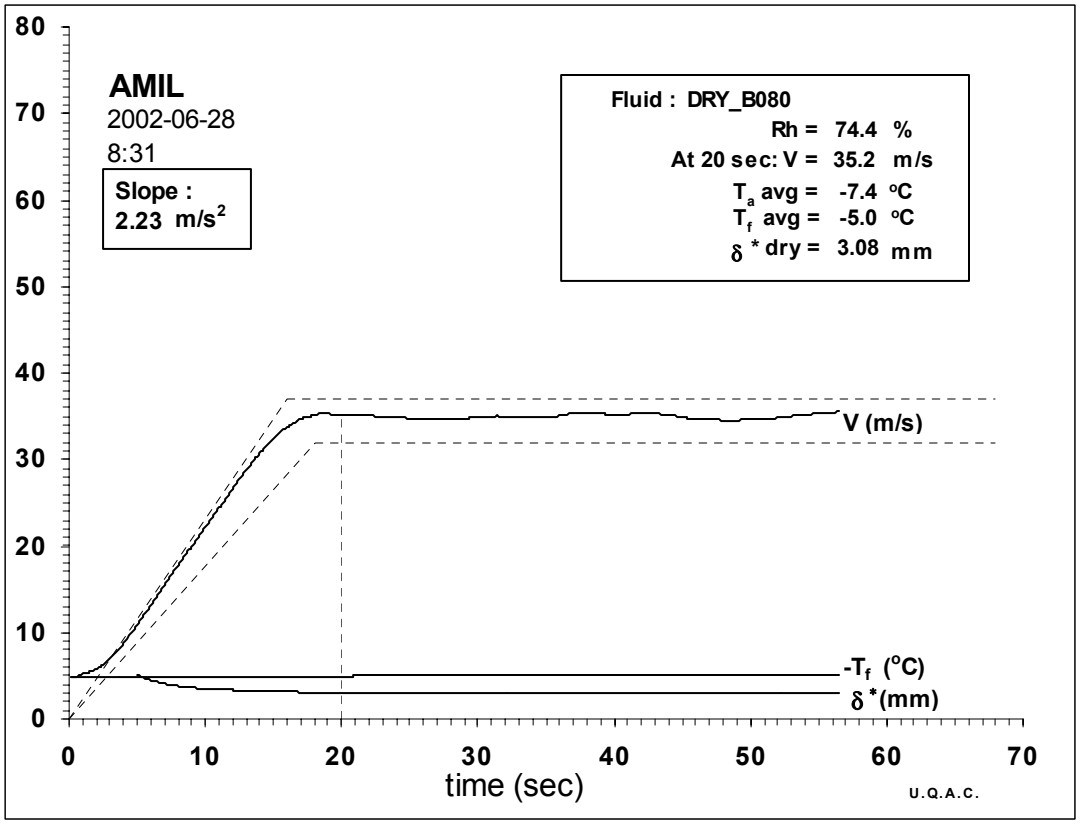
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	0.5	1.6	86.3	2.82	33.2	-0.01	3.03
20	0.5	1.6	87.7	2.86	33.5	0.00	3.05
21	0.5	1.6	85.3	2.85	33.4	0.00	3.05

Averages:

20	0.5	**1.6**	86.7	2.85	33.4	0.00	**3.05**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



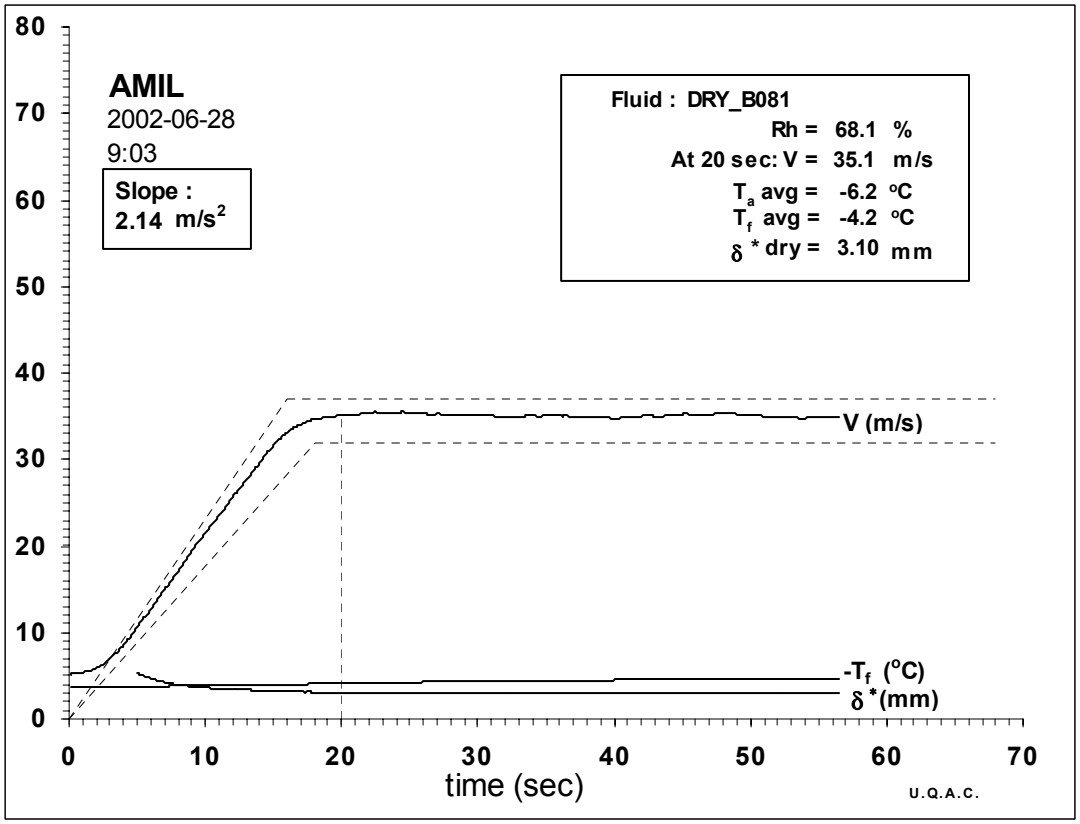
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-7.5	-5.0	73.6	3.21	34.9	0.00	3.06
20	-7.5	-5.0	75.5	3.29	35.3	0.00	3.08
21	-7.5	-5.0	73.2	3.25	35.1	0.01	3.11

Averages:

20	-7.5	**-5.0**	74.4	3.26	35.2	0.00	**3.08**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



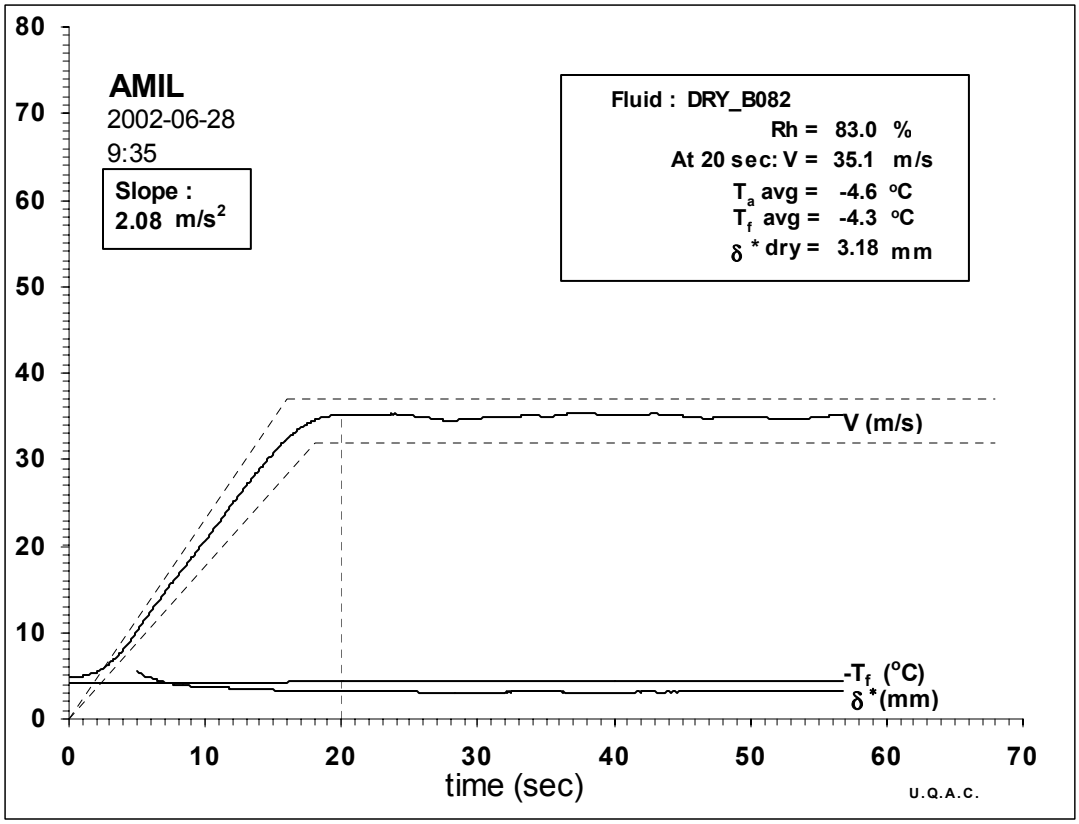
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-6.4	-4.1	68.9	3.24	35.1	0.00	3.08
20	-6.5	-4.1	68.6	3.19	34.9	0.01	3.13
21	-6.6	-4.2	66.7	3.32	35.6	0.00	3.07

Averages:

20	-6.5	**-4.1**	68.1	3.24	35.1	0.01	**3.10**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



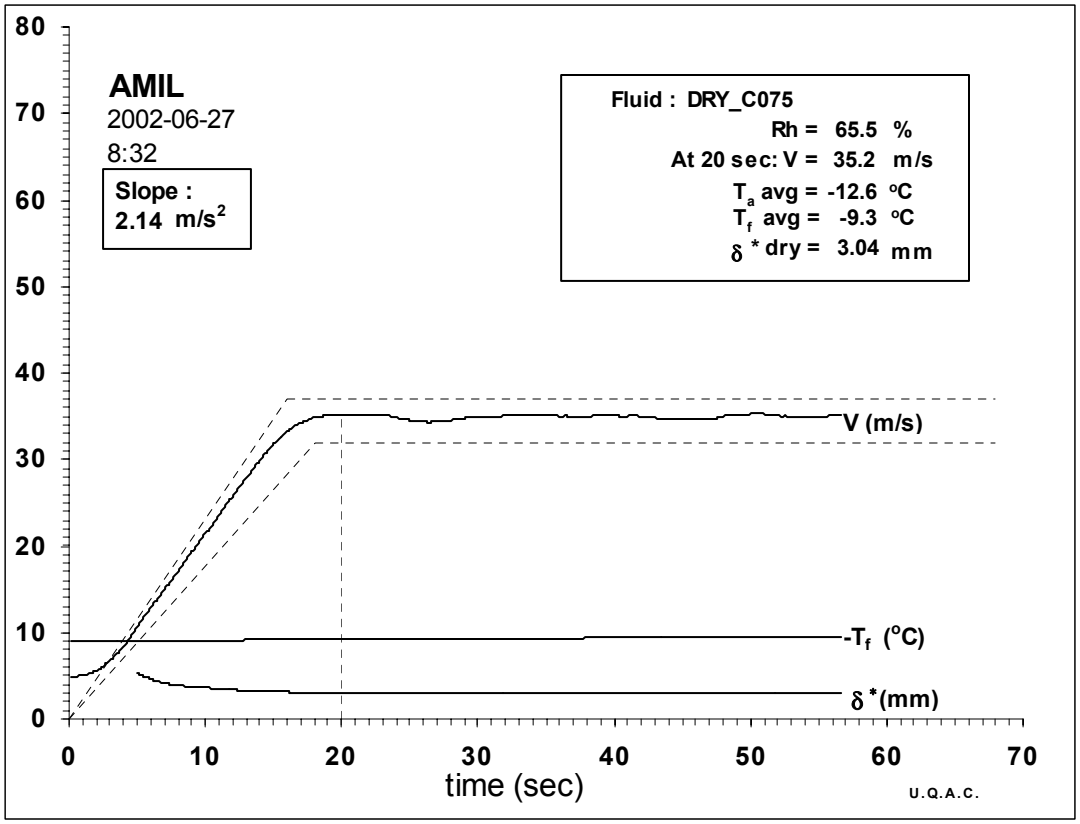
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-4.7	-4.3	83.0	3.18	34.9	0.02	3.17
20	-4.7	-4.3	83.5	3.21	35.1	0.01	3.15
21	-4.7	-4.3	82.0	3.27	35.4	0.03	3.24

Averages:

20	-4.7	**-4.3**	83.0	3.22	35.1	0.02	**3.18**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



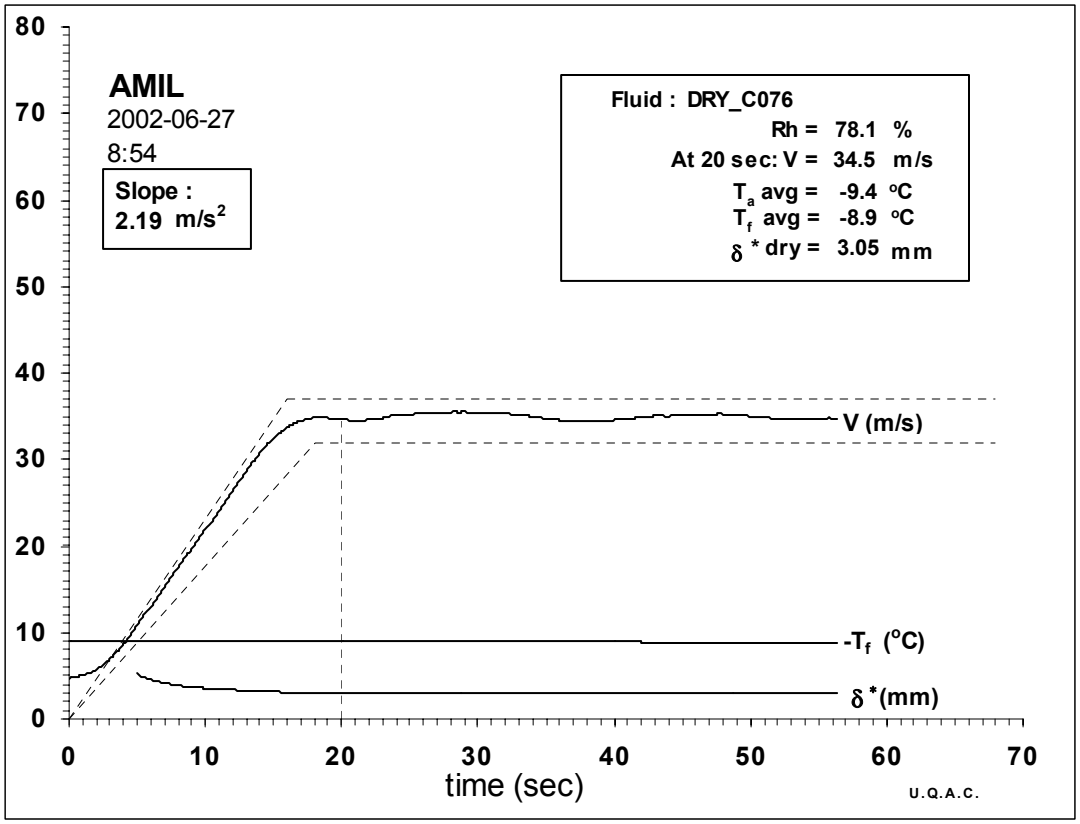
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-12.8	-9.2	65.0	3.32	35.1	-0.01	3.04
20	-12.8	-9.2	65.7	3.31	35.1	-0.01	3.03
21	-12.8	-9.2	65.8	3.34	35.3	0.00	3.06

Averages:

20	-12.8	**-9.2**	65.5	3.32	35.2	-0.01	**3.04**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



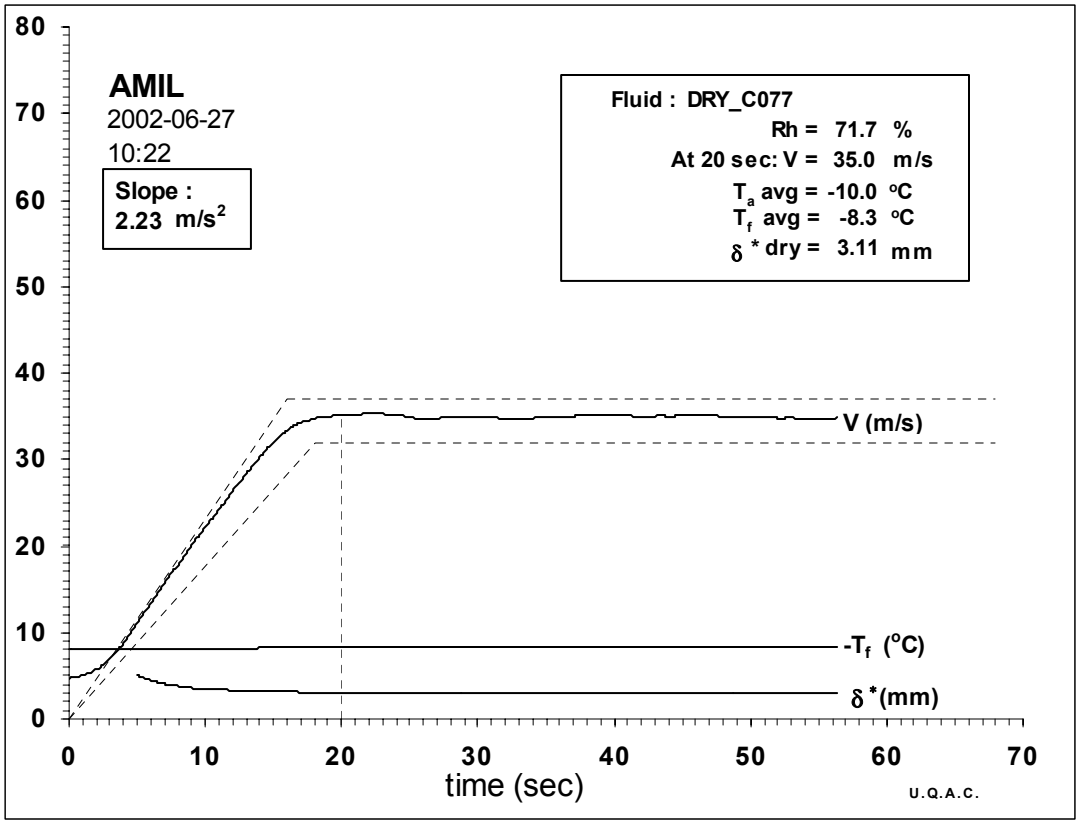
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-9.5	-9.0	77.3	3.26	35.0	-0.01	3.04
20	-9.6	-8.9	79.0	3.13	34.4	-0.01	3.02
21	-9.6	-8.9	77.3	3.10	34.2	0.01	3.12

Averages:

20	-9.6	**-8.9**	78.1	3.15	34.5	0.00	**3.05**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



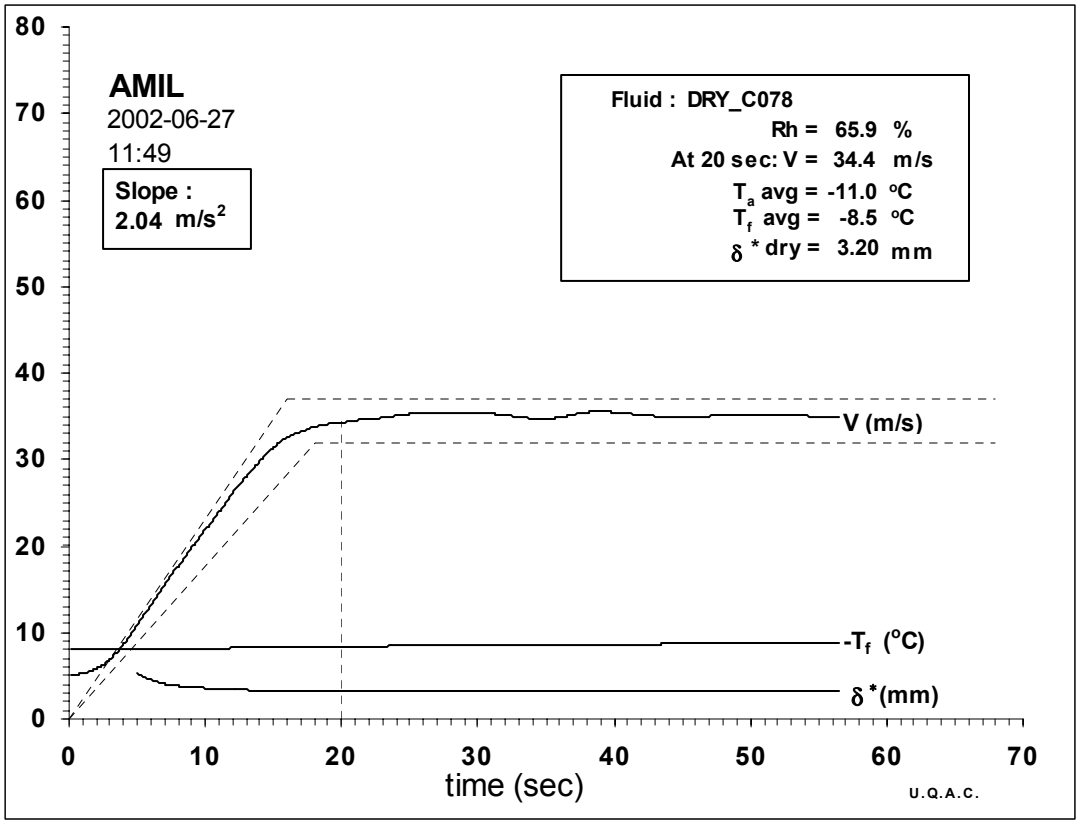
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-10.2	-8.3	70.2	3.20	34.7	0.00	3.07
20	-10.1	-8.3	70.4	3.26	35.0	0.01	3.14
21	-10.1	-8.3	75.2	3.30	35.2	0.01	3.10

Averages:

20	-10.2	**-8.3**	71.7	3.26	35.0	0.01	**3.11**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



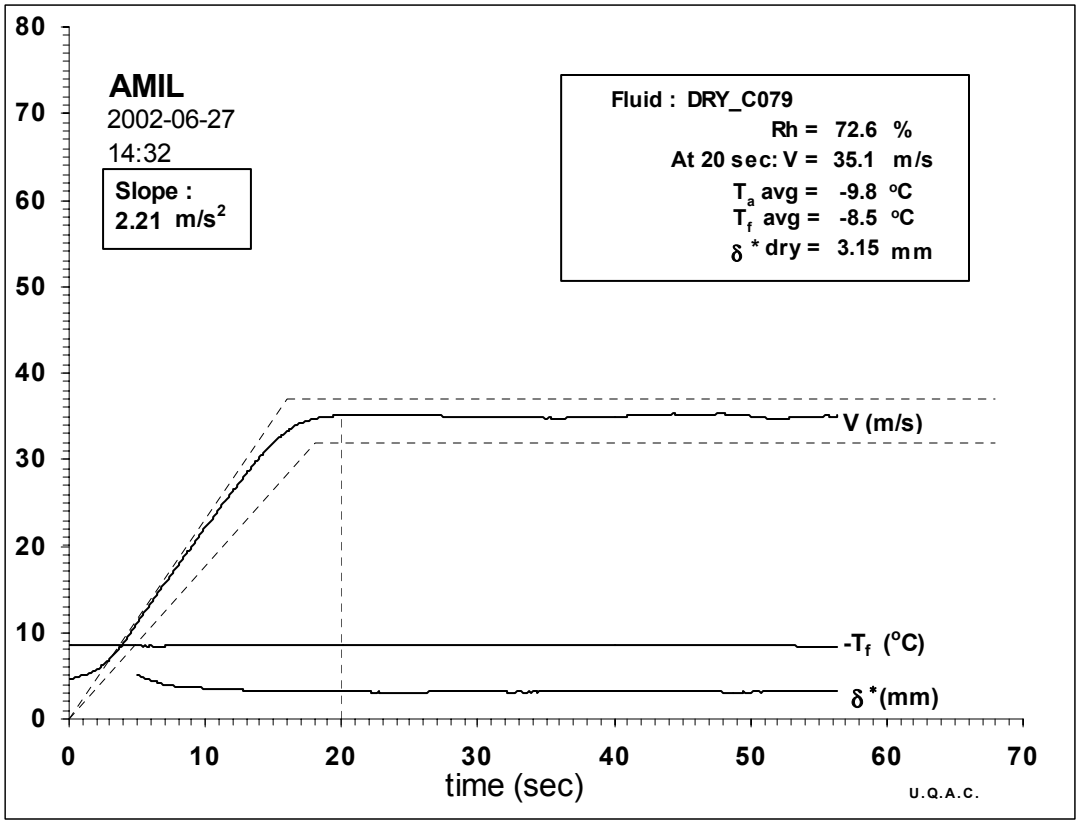
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-11.2	-8.4	66.3	3.05	33.8	0.03	3.26
20	-11.2	-8.4	66.1	3.18	34.5	0.02	3.17
21	-11.3	-8.4	65.2	3.20	34.6	0.02	3.20

Averages:

20	-11.2	**-8.4**	65.9	3.15	34.4	0.02	**3.20**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



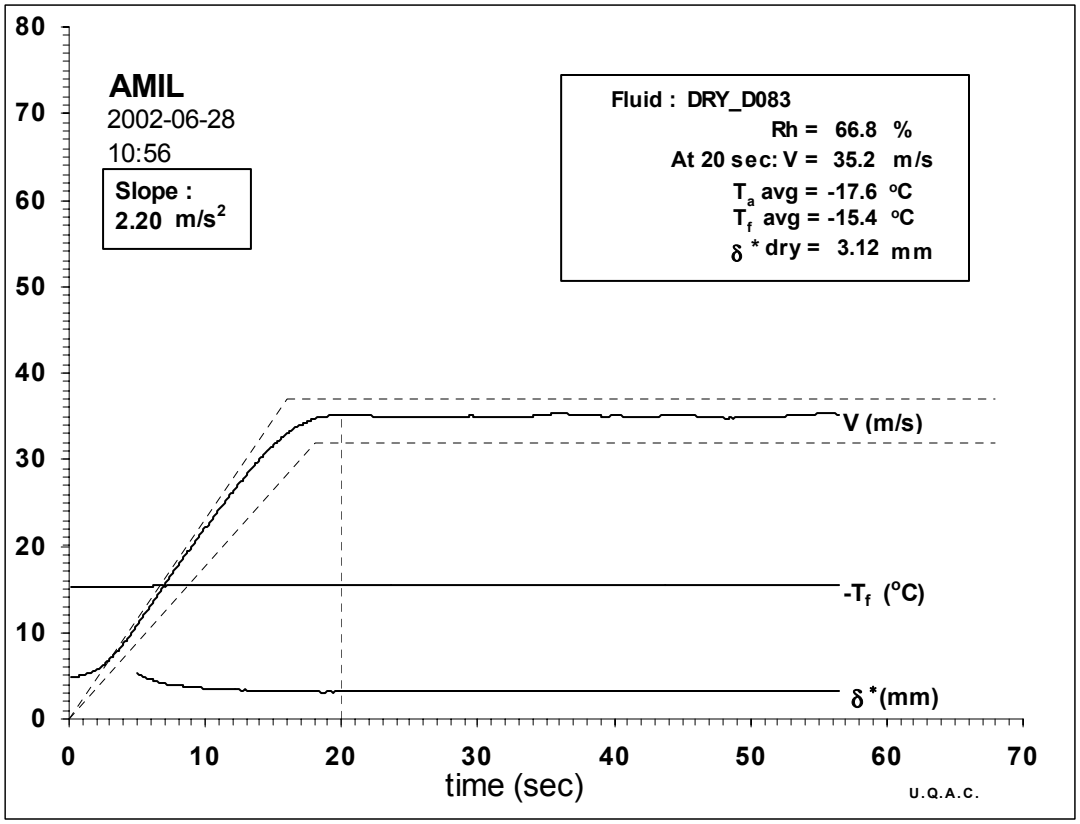
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-10.0	-8.5	76.6	3.27	35.1	0.01	3.13
20	-10.0	-8.5	68.6	3.28	35.1	0.02	3.16
21	-9.9	-8.5	75.9	3.28	35.1	0.02	3.16

Averages:

20	-10.0	**-8.5**	72.6	3.28	35.1	0.02	**3.15**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



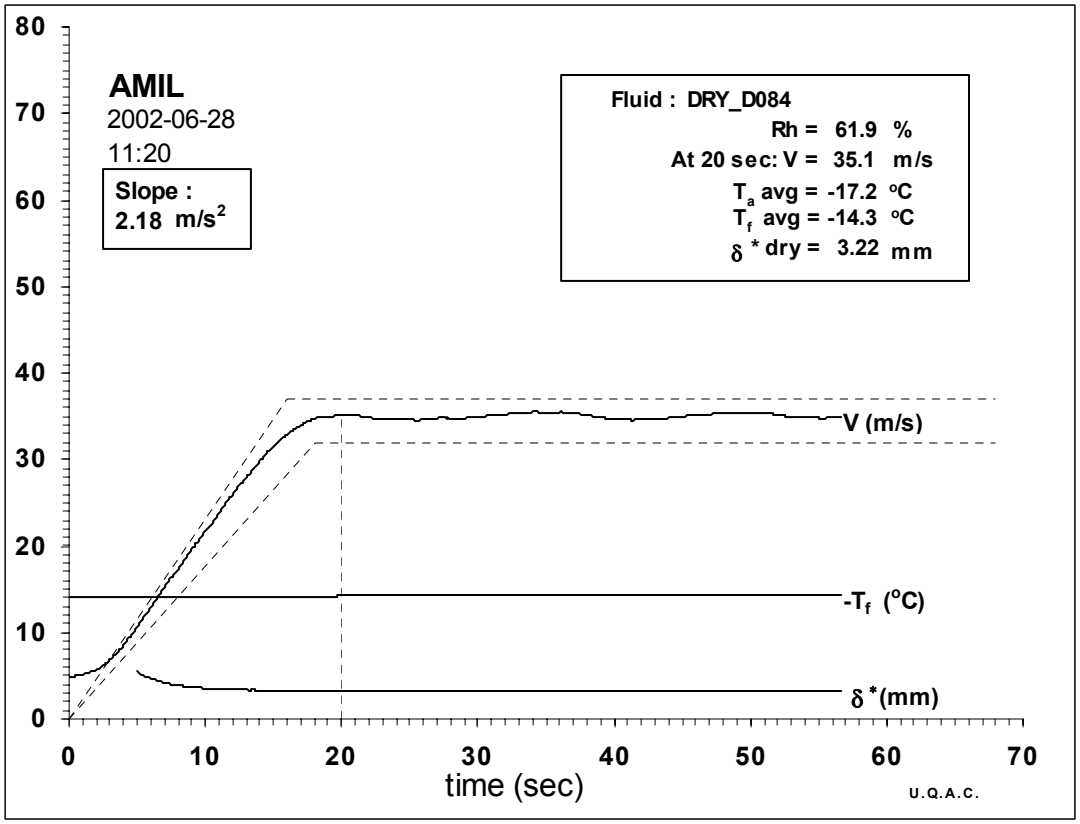
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-17.8	-15.4	66.9	3.50	35.8	0.00	3.05
20	-17.8	-15.4	67.3	3.40	35.2	0.01	3.11
21	-17.8	-15.4	65.8	3.31	34.8	0.03	3.21

Averages:

20	-17.8	**-15.4**	66.8	3.40	35.2	0.01	**3.12**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



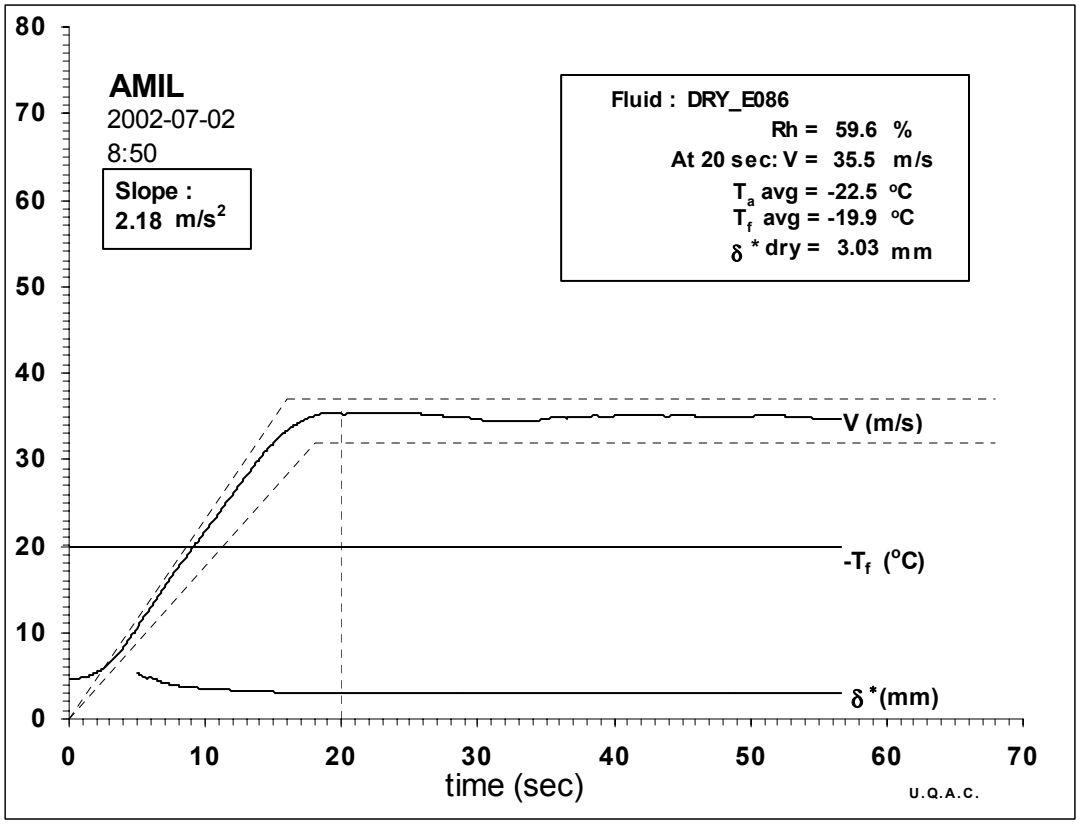
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-17.4	-14.2	59.4	3.45	35.5	0.04	3.26
20	-17.4	-14.2	59.0	3.38	35.1	0.02	3.19
21	-17.4	-14.2	68.8	3.29	34.7	0.03	3.23

Averages:

20	-17.4	**-14.2**	61.9	3.37	35.1	0.03	**3.22**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



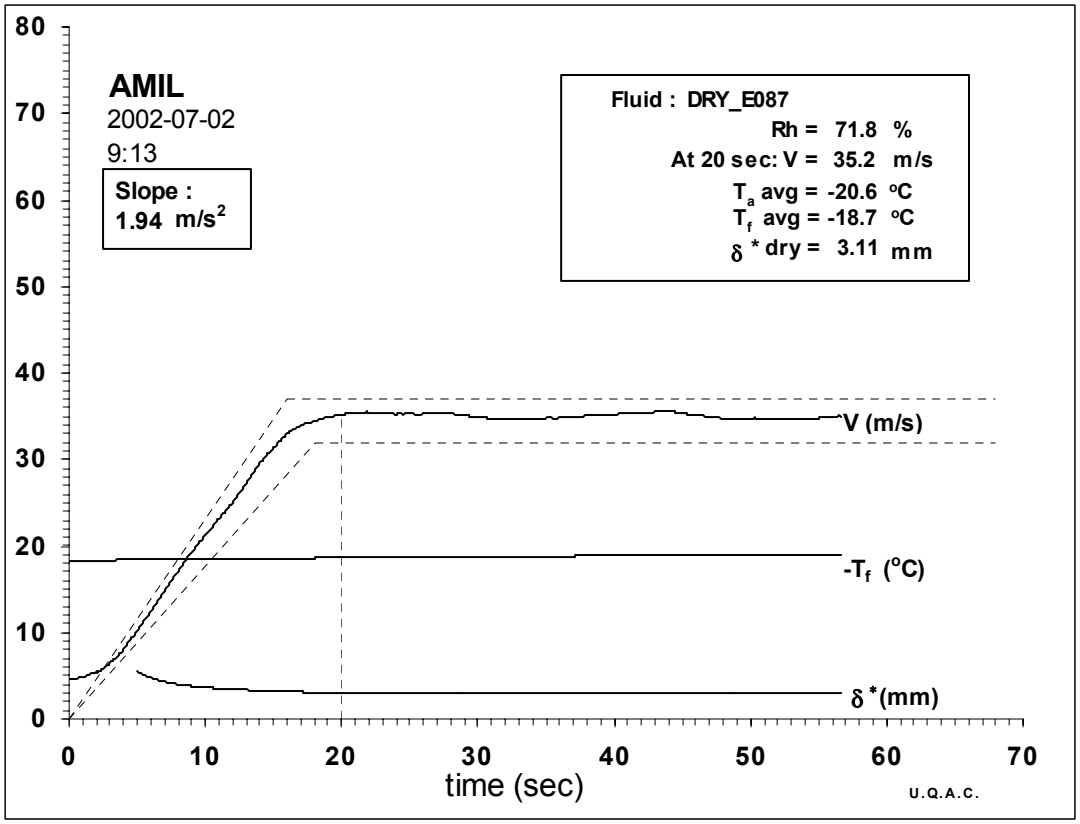
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-22.7	-19.9	59.5	3.54	35.6	-0.01	3.01
20	-22.7	-19.9	59.6	3.55	35.7	-0.01	3.04
21	-22.7	-19.9	59.6	3.45	35.1	-0.01	3.04

Averages:

20	-22.7	**-19.9**	59.6	3.52	35.5	-0.01	**3.03**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



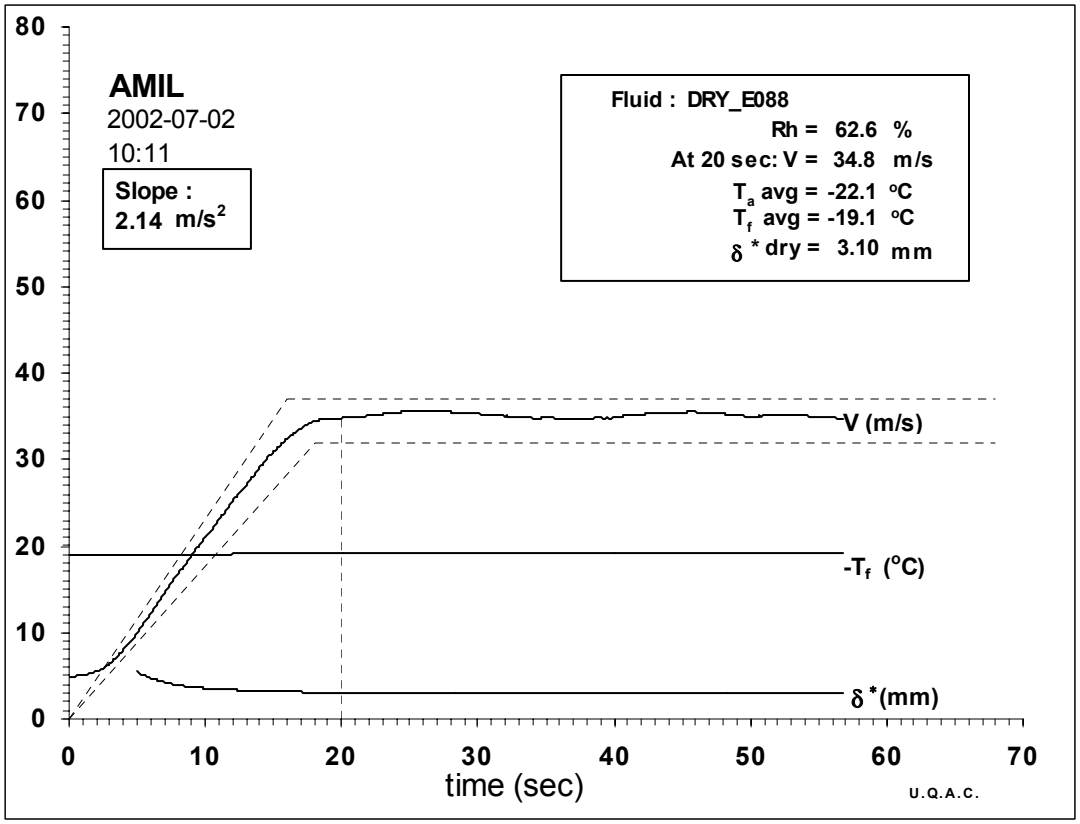
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-20.7	-18.6	71.6	3.37	34.8	-0.01	3.04
20	-20.8	-18.6	71.8	3.43	35.2	0.02	3.15
21	-20.9	-18.7	72.0	3.51	35.6	0.00	3.08

Averages:

20	-20.8	**-18.7**	71.8	3.44	35.2	0.01	**3.11**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



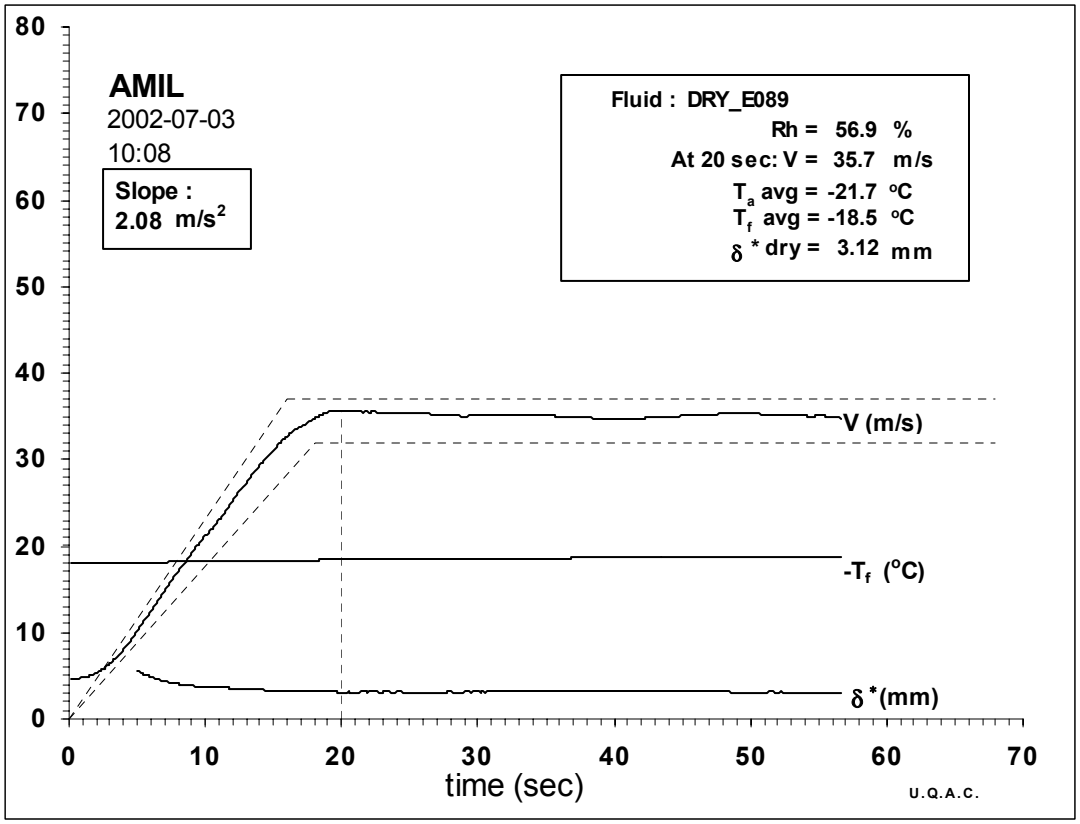
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-22.3	-19.2	61.3	3.43	35.1	0.01	3.11
20	-22.3	-19.1	64.3	3.41	35.0	0.01	3.10
21	-22.3	-19.2	60.8	3.29	34.4	0.00	3.08

Averages:

20	-22.3	**-19.2**	62.6	3.38	34.8	0.01	**3.10**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



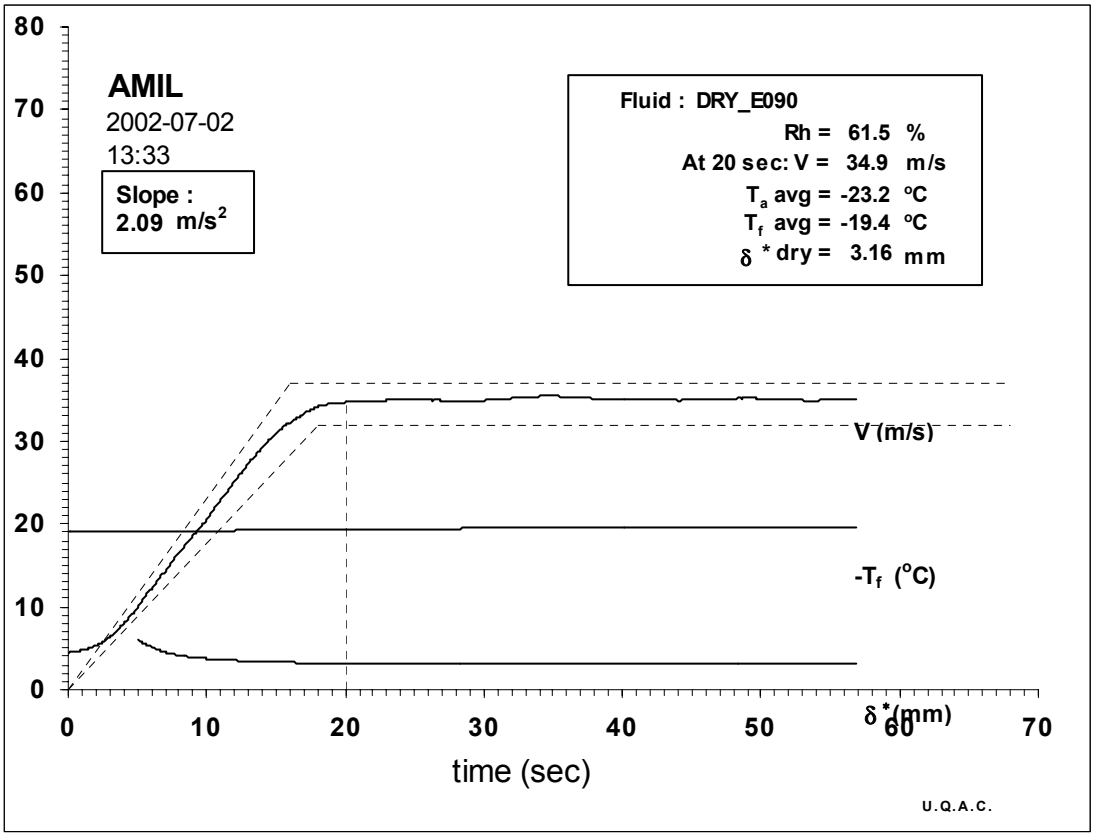
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-22.0	-18.4	57.1	3.54	35.6	-0.01	3.00
20	-22.0	-18.4	58.1	3.53	35.6	0.02	3.18
21	-22.0	-18.4	54.8	3.59	35.9	0.01	3.13

Averages:

20	-22.0	**-18.4**	56.9	3.55	35.7	0.01	**3.12**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



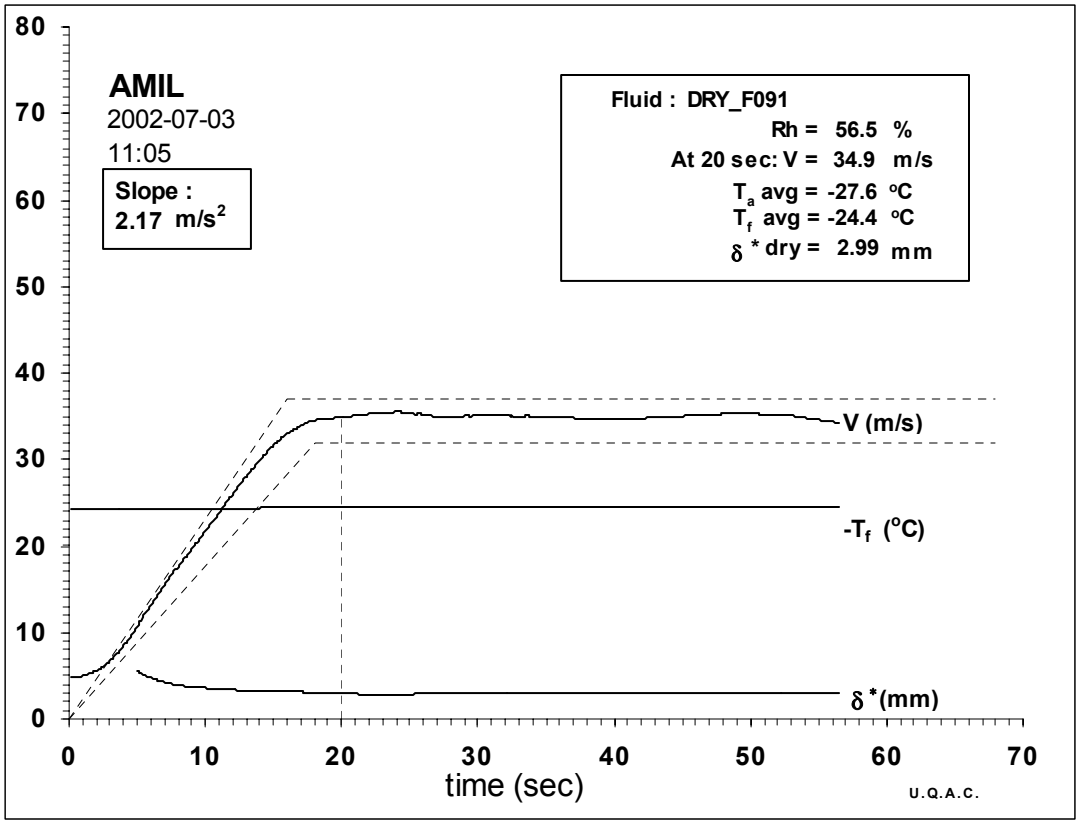
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-23.4	-19.4	58.8	3.40	34.8	0.02	3.16
20	-23.4	-19.4	62.2	3.44	35.0	0.01	3.15
21	-23.5	-19.4	62.6	3.37	34.7	0.02	3.20

Averages:

20	-23.4	**-19.4**	61.5	3.41	34.9	0.02	**3.16**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



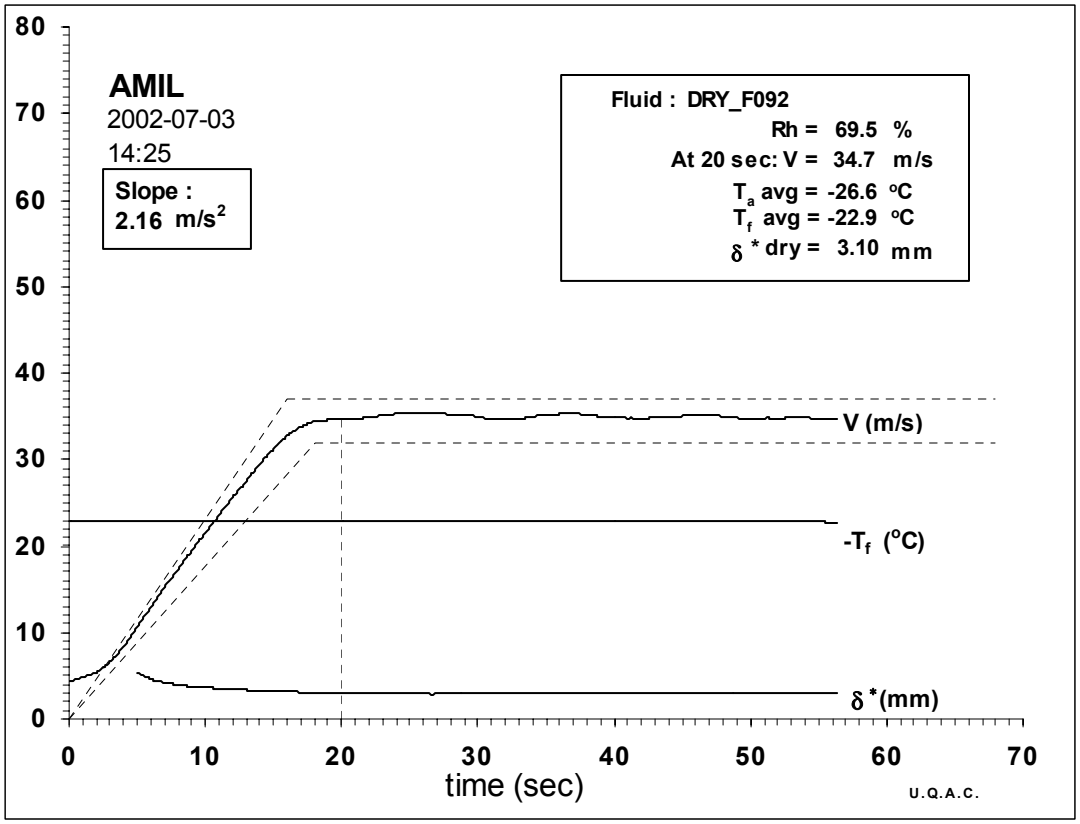
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-27.7	-24.4	55.8	3.40	34.5	-0.01	3.02
20	-27.7	-24.4	54.7	3.46	34.8	-0.01	3.01
21	-27.7	-24.5	59.9	3.52	35.2	-0.02	2.95

Averages:

20	-27.7	**-24.4**	56.5	3.46	34.9	-0.01	**2.99**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



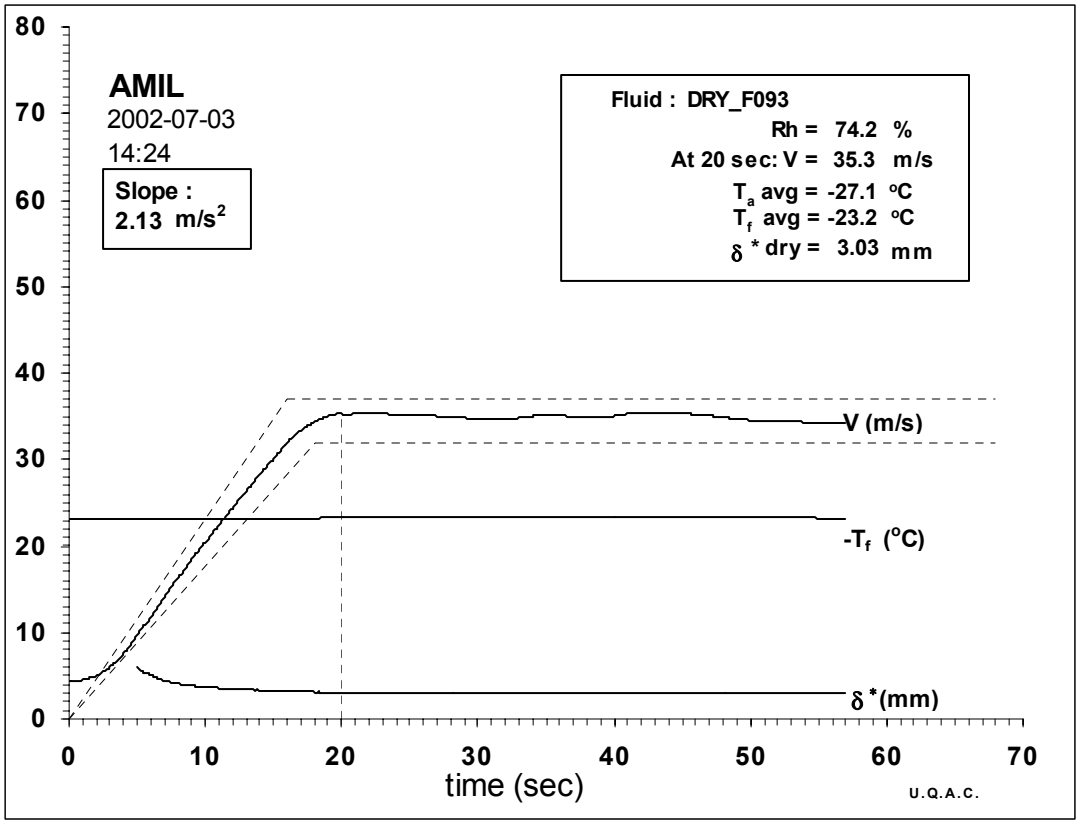
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-26.8	-23.0	70.1	3.48	35.0	0.01	3.11
20	-26.7	-23.0	69.0	3.40	34.6	0.00	3.06
21	-26.7	-23.0	70.0	3.40	34.6	0.01	3.13

Averages:

20	-26.7	**-23.0**	69.5	3.42	34.7	0.01	**3.10**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-27.4	-23.2	77.7	3.50	35.1	0.01	3.15
20	-27.4	-23.3	73.5	3.53	35.2	-0.01	3.02
21	-27.4	-23.3	72.4	3.59	35.5	-0.02	2.95

Averages:

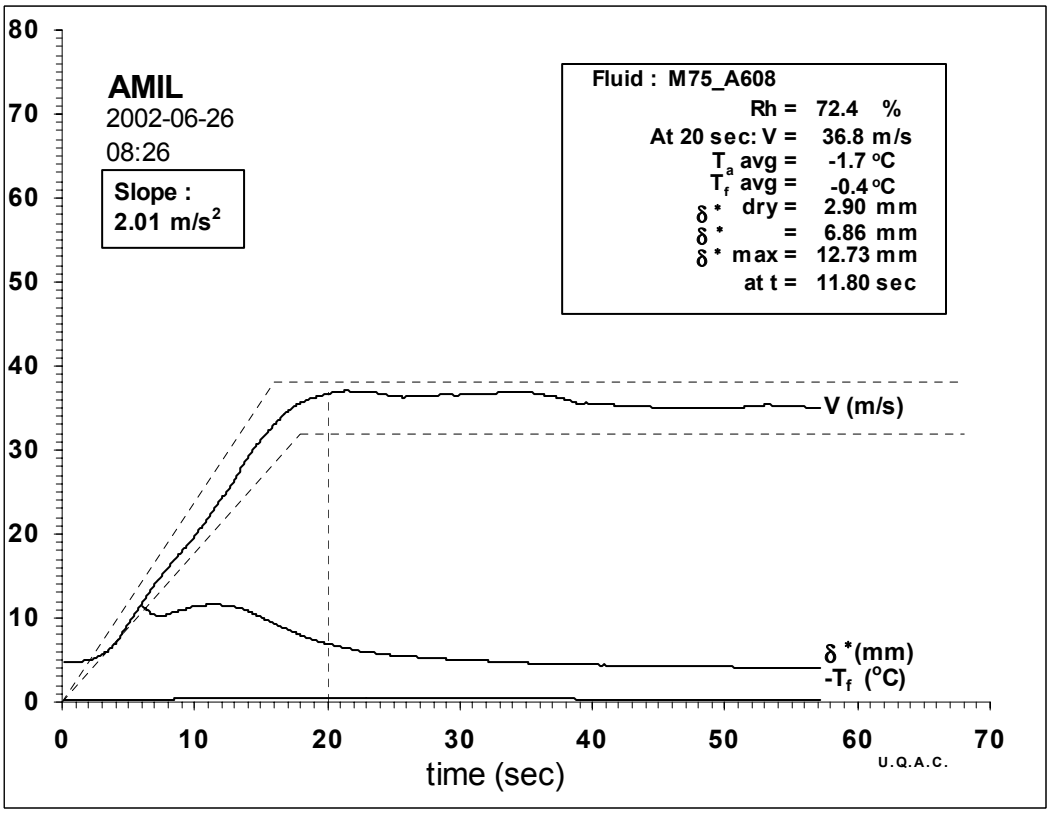
20	-27.4	**-23.3**	74.2	3.54	35.3	-0.01	**3.03**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.10 RUNS WITH REFERENCE FLUID M-034, TYPE IV FLUID SERIES.

FPC-608



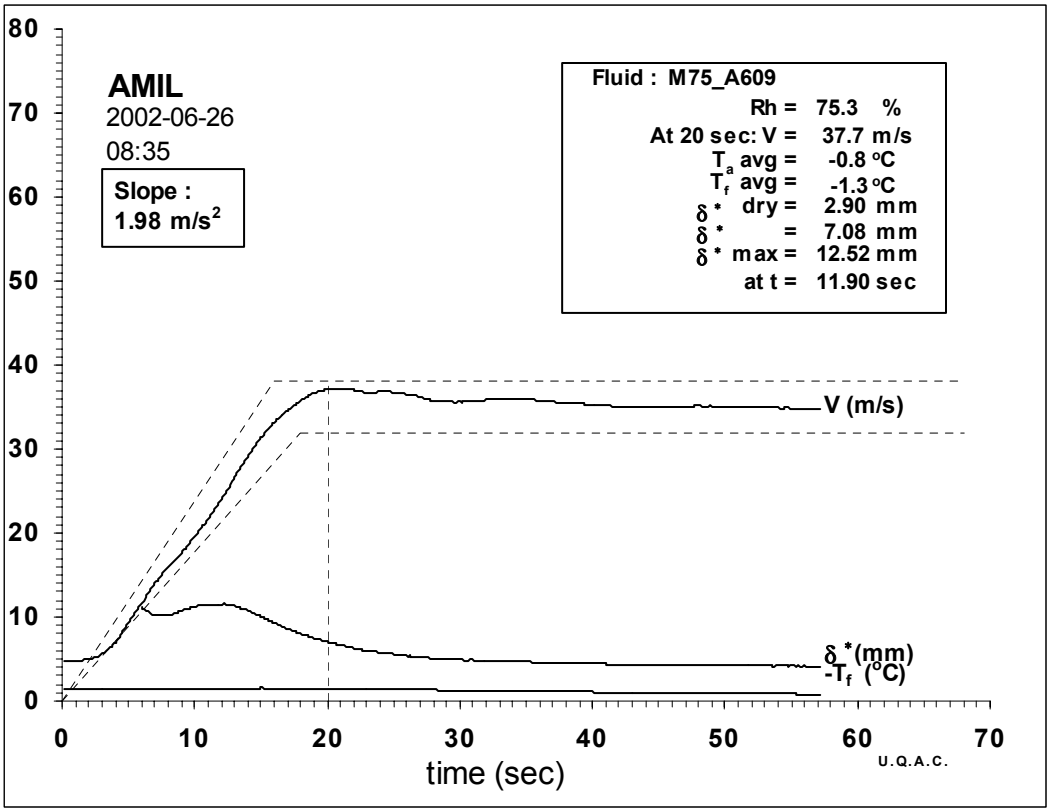
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-1.8	-0.5	76.3	3.47	36.7	0.29	7.33
20	-1.8	-0.5	70.3	3.55	37.1	0.26	6.86
21	-1.8	-0.5	72.5	3.38	36.2	0.22	6.49

Averages :

20	-1.8	**-0.5**	72.4	3.49	36.8	0.26	**6.86**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



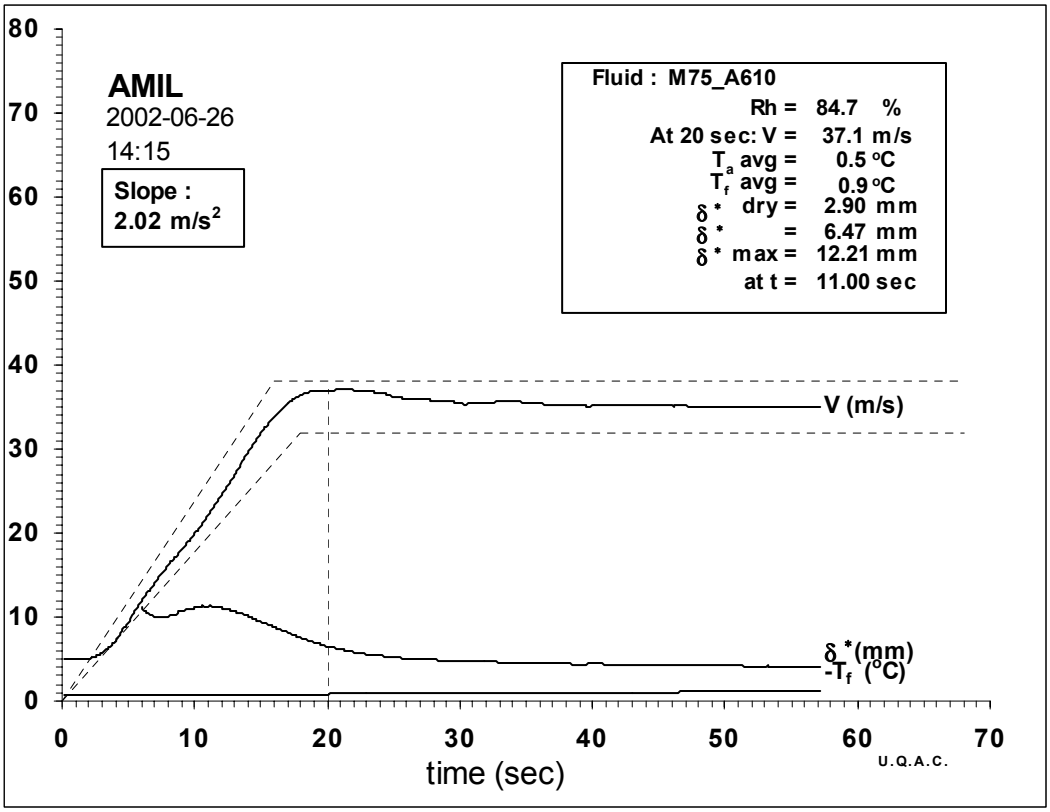
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.9	-1.5	76.5	3.52	37.0	0.30	7.44
20	-0.9	-1.5	74.4	3.68	37.8	0.29	7.09
21	-0.8	-1.5	75.9	3.75	38.2	0.26	6.74

Averages :

20	-0.9	**-1.5**	75.3	3.66	37.7	0.28	**7.08**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



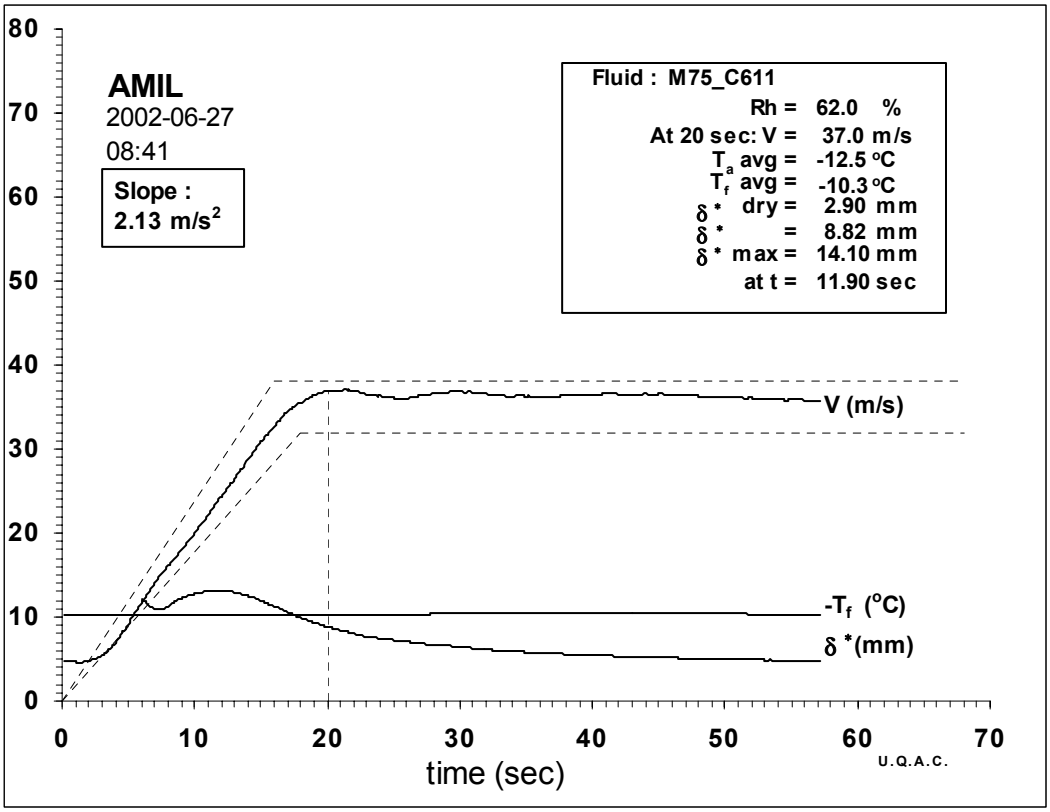
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.3	0.8	85.2	3.55	37.2	0.25	6.75
20	0.4	0.8	83.3	3.55	37.3	0.23	6.54
21	0.4	0.8	86.7	3.42	36.6	0.19	6.12

Averages :

20	0.4	**0.8**	84.7	3.51	37.1	0.23	**6.47**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



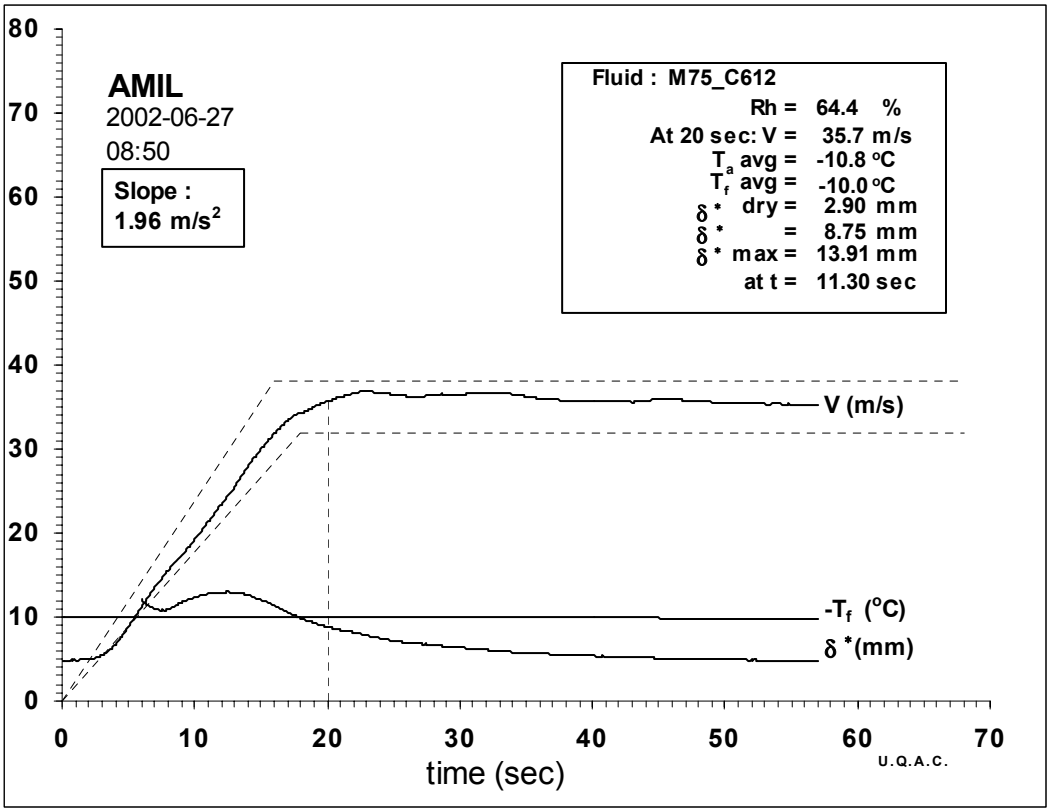
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-12.8	-10.3	59.9	3.55	36.3	0.44	9.10
20	-12.8	-10.3	63.8	3.63	36.8	0.44	8.98
21	-12.8	-10.3	60.7	3.88	38.0	0.41	8.33

Averages :

20	-12.8	**-10.3**	62.0	3.68	37.0	0.43	**8.82**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



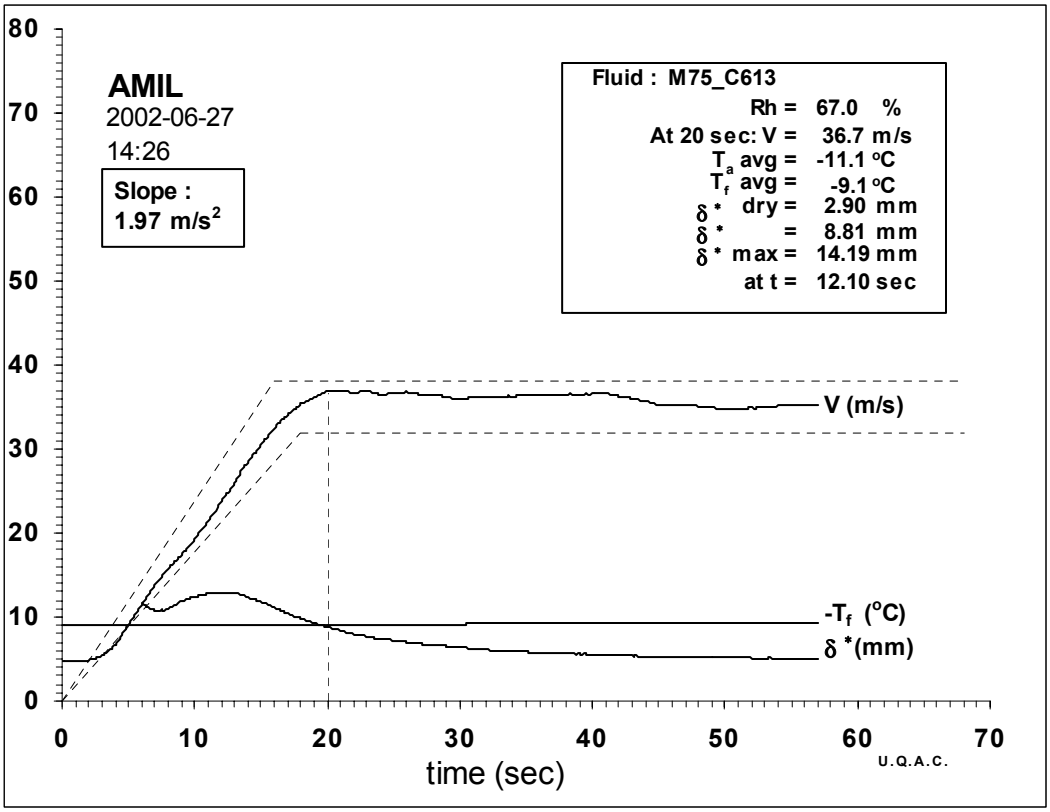
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-11.0	-10.0	64.3	3.32	35.2	0.40	8.91
20	-11.0	-10.0	65.4	3.40	35.7	0.40	8.78
21	-11.0	-10.0	62.8	3.47	36.1	0.39	8.58

Averages :

20	-11.0	**-10.0**	64.4	3.40	35.7	0.39	**8.75**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



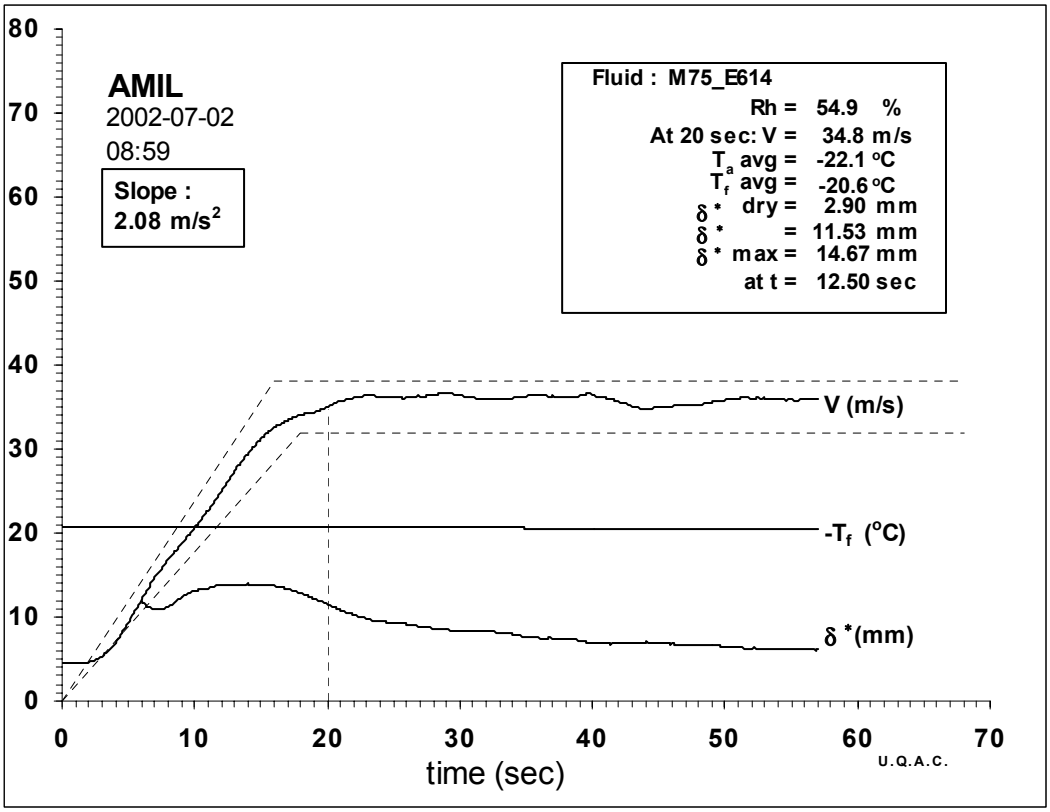
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-11.4	-9.0	64.3	3.66	37.0	0.47	9.32
20	-11.4	-9.0	66.6	3.63	36.8	0.42	8.78
21	-11.4	-9.0	70.0	3.54	36.4	0.39	8.45

Averages :

20	-11.4	**-9.0**	67.0	3.61	36.7	0.42	**8.81**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



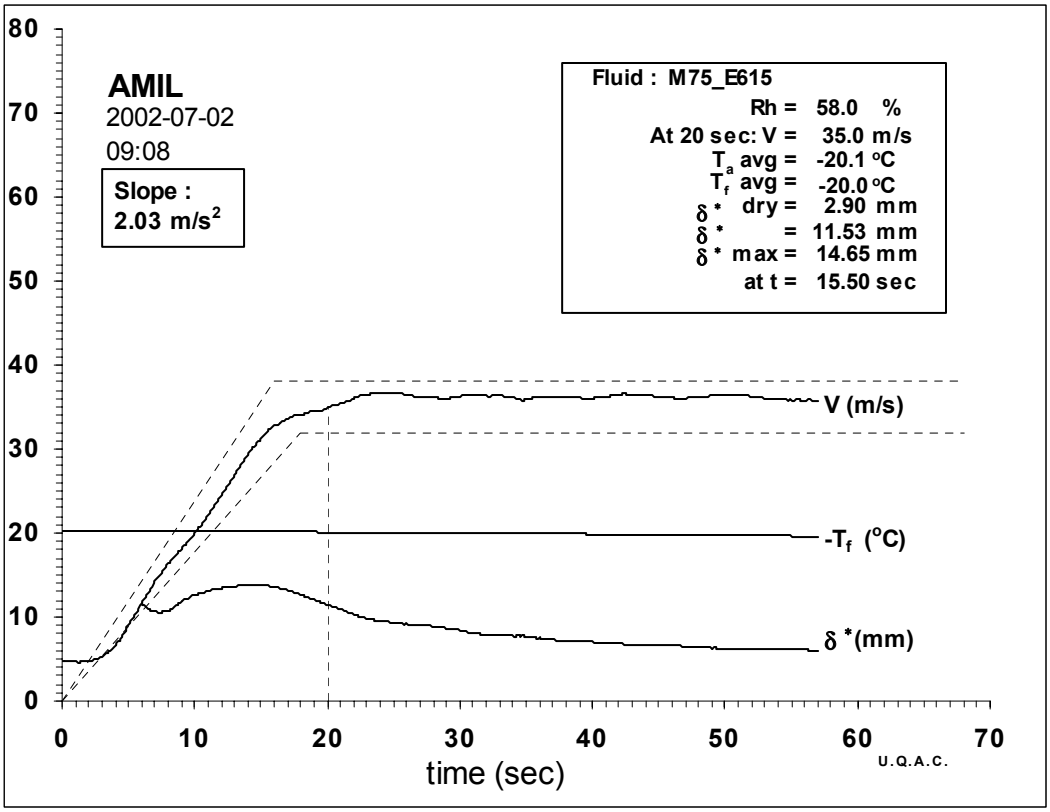
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-22.4	-20.7	54.8	3.47	35.3	0.65	11.70
20	-22.4	-20.6	55.1	3.35	34.6	0.62	11.65
21	-22.4	-20.6	54.8	3.35	34.7	0.59	11.19

Averages :

20	-22.4	**-20.6**	54.9	3.38	34.8	0.62	**11.53**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



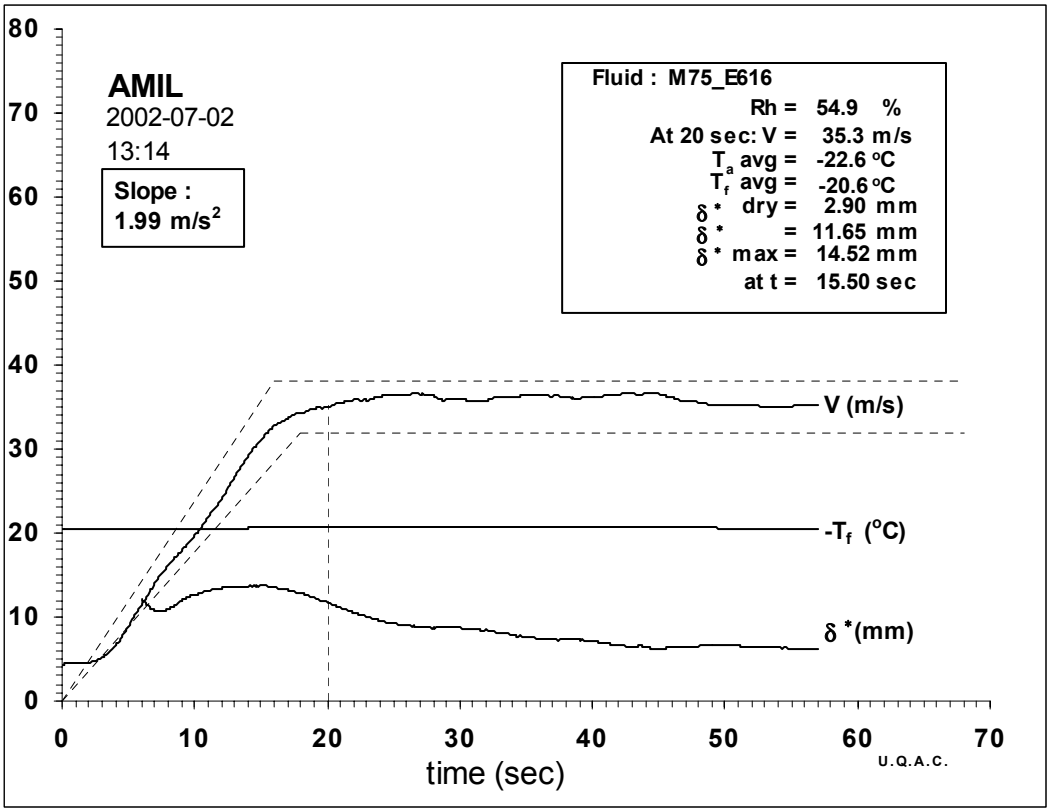
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-20.4	-20.1	57.9	3.32	34.6	0.65	12.04
20	-20.4	-20.1	58.5	3.33	34.7	0.61	11.49
21	-20.4	-20.1	57.4	3.53	35.7	0.61	11.17

Averages :

20	-20.4	**-20.1**	58.0	3.38	35.0	0.62	**11.53**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



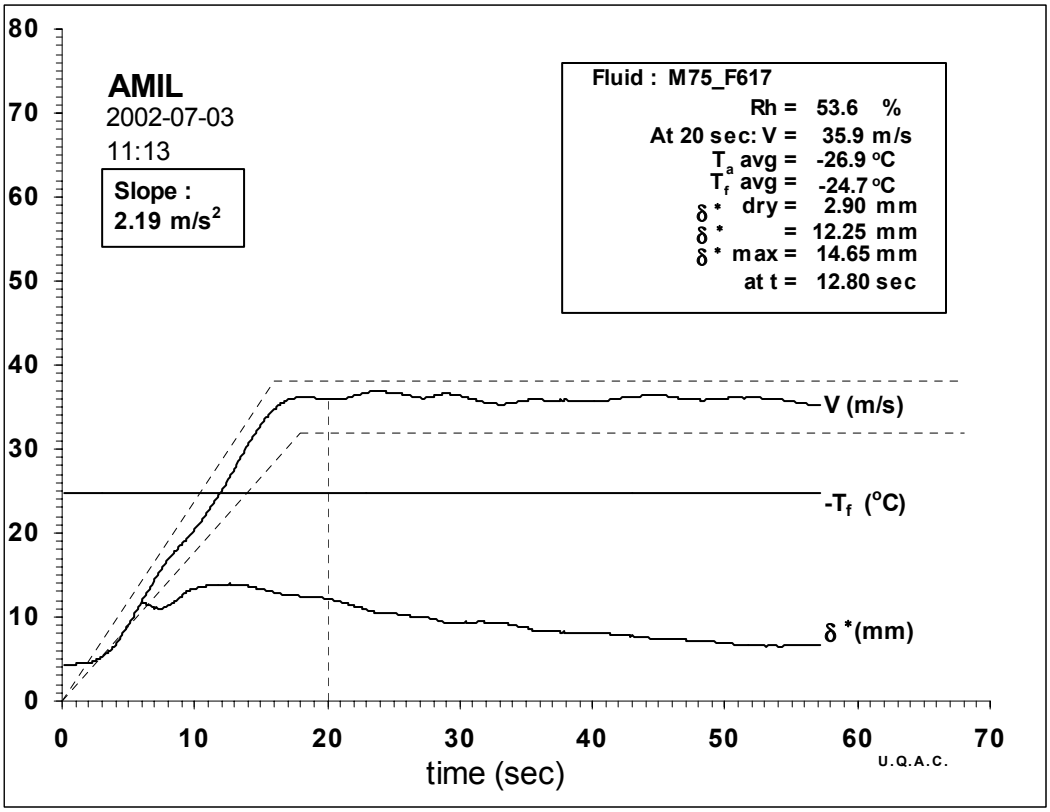
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-22.9	-20.6	54.9	3.47	35.2	0.68	12.01
20	-22.9	-20.6	54.9	3.40	34.9	0.66	11.89
21	-22.8	-20.6	54.8	3.62	36.0	0.61	10.94

Averages :

20	-22.9	**-20.6**	54.9	3.48	35.3	0.65	**11.65**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



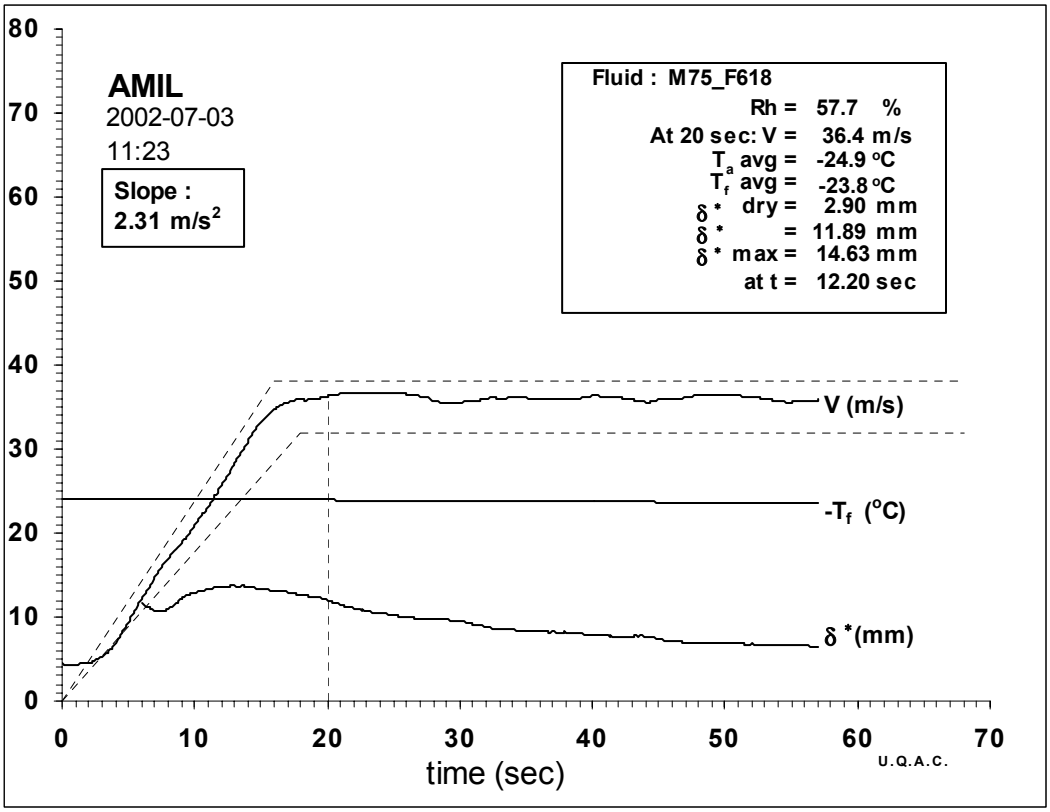
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-27.2	-24.8	52.2	3.63	35.7	0.82	13.16
20	-27.2	-24.8	53.6	3.75	36.3	0.72	11.87
21	-27.2	-24.8	54.6	3.56	35.4	0.71	12.13

Averages :

20	-27.2	**-24.8**	53.6	3.67	35.9	0.74	**12.25**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



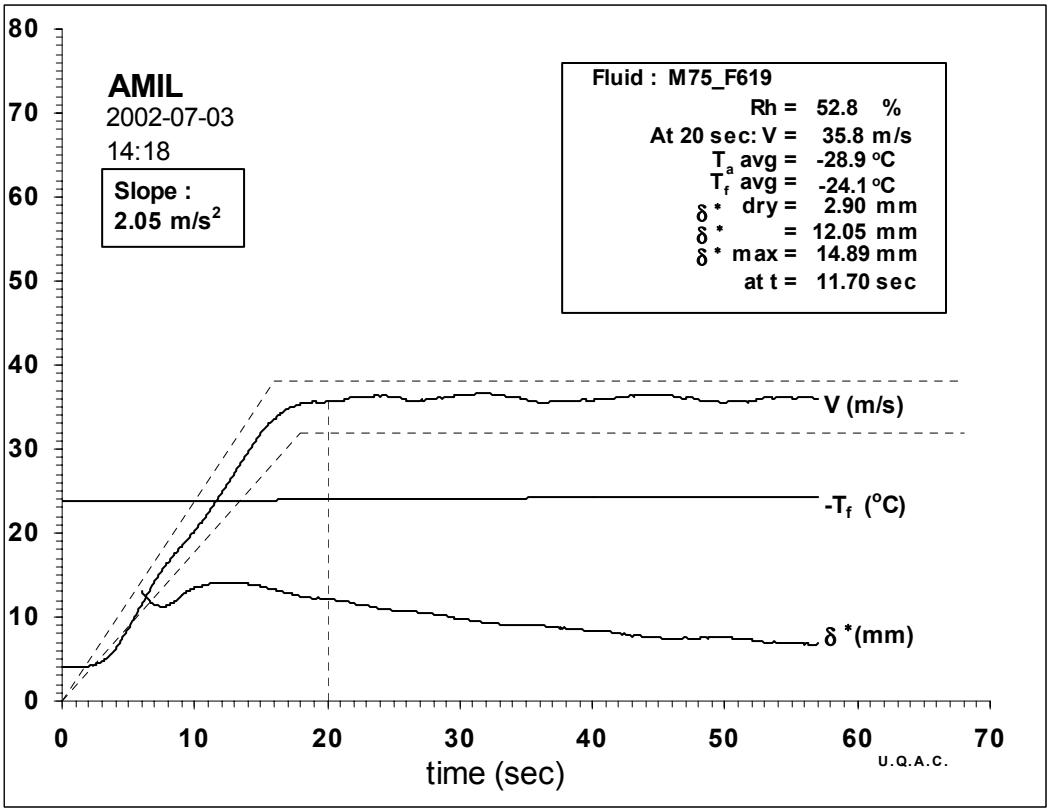
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-25.2	-24.0	57.9	3.64	35.9	0.72	12.10
20	-25.2	-23.9	58.7	3.69	36.2	0.73	12.10
21	-25.1	-23.9	55.8	3.90	37.2	0.70	11.36

Averages :

20	-25.2	**-23.9**	57.7	3.74	36.4	0.72	**11.89**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-29.2	-24.0	52.6	3.57	35.3	0.75	12.55
20	-29.2	-24.0	52.6	3.67	35.8	0.71	11.87
21	-29.2	-24.0	53.2	3.76	36.2	0.73	11.95

Averages :

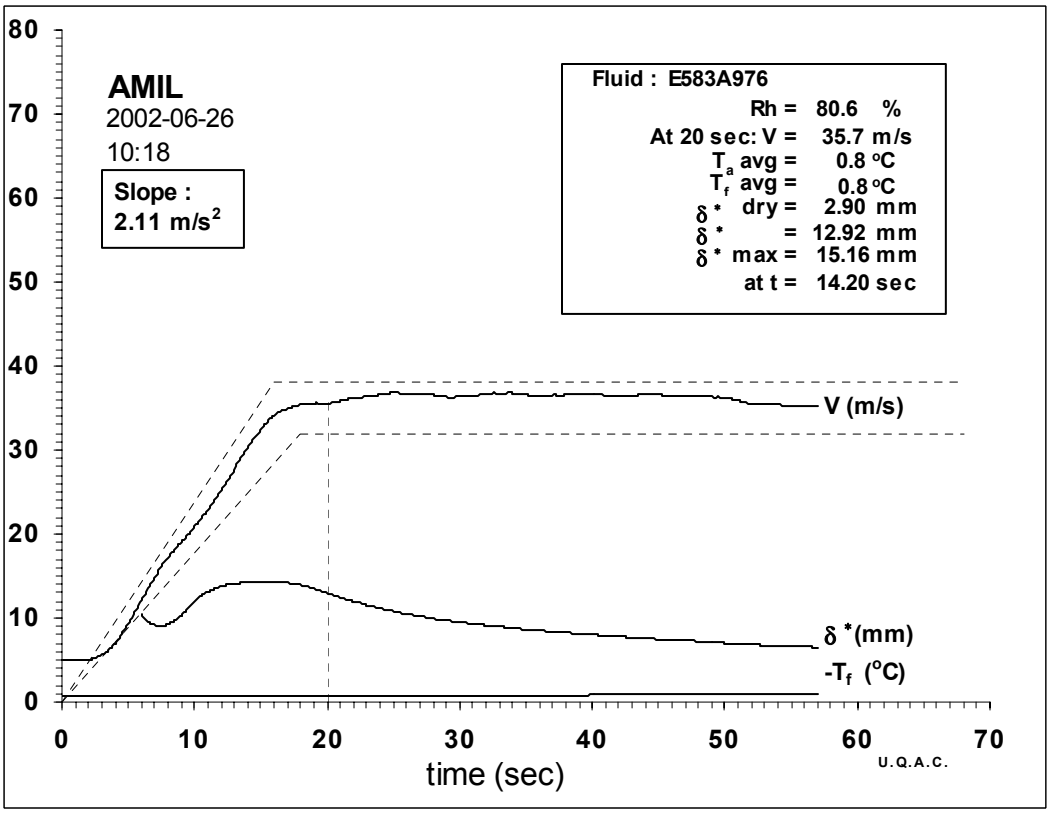
20	-29.2	**-24.0**	52.8	3.67	35.8	0.72	**12.05**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.11 OCTAGON MAXFLIGHT, LOT F-23195C, NEAT E-583.

FP-976



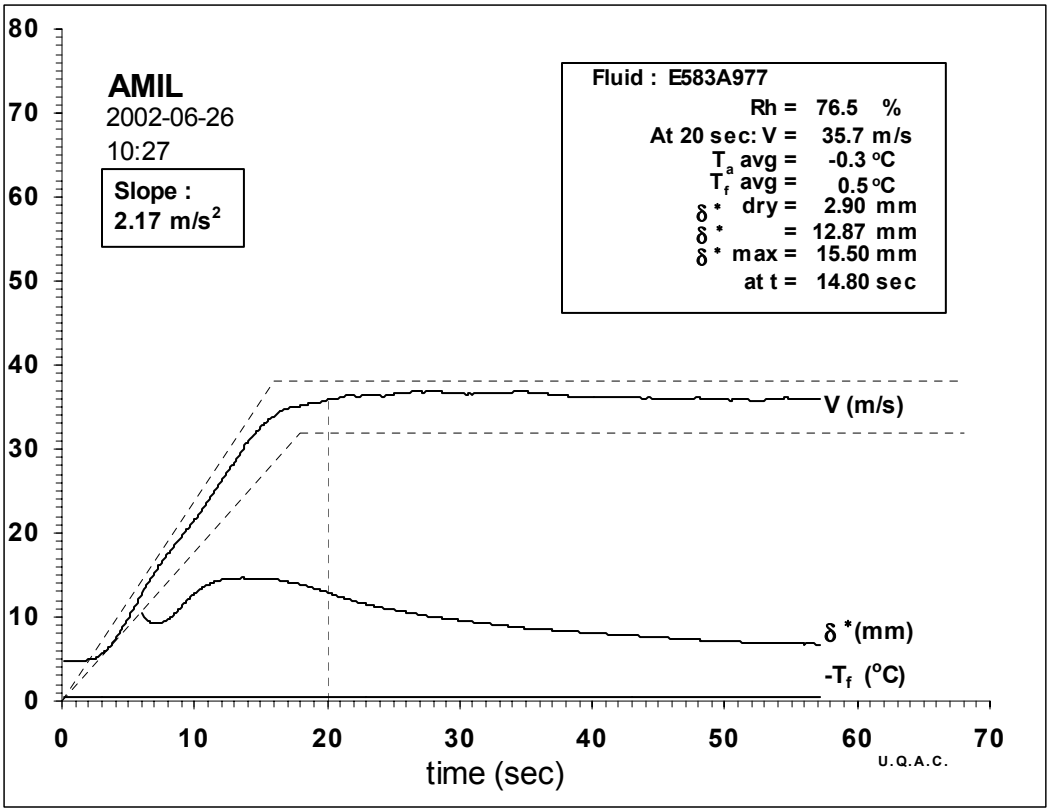
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.7	0.7	82.7	3.19	35.3	0.75	13.49
20	0.7	0.7	80.6	3.27	35.8	0.71	12.82
21	0.7	0.7	79.0	3.32	36.1	0.70	12.62

Averages :

20	0.7	**0.7**	80.6	3.27	35.7	0.72	**12.92**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



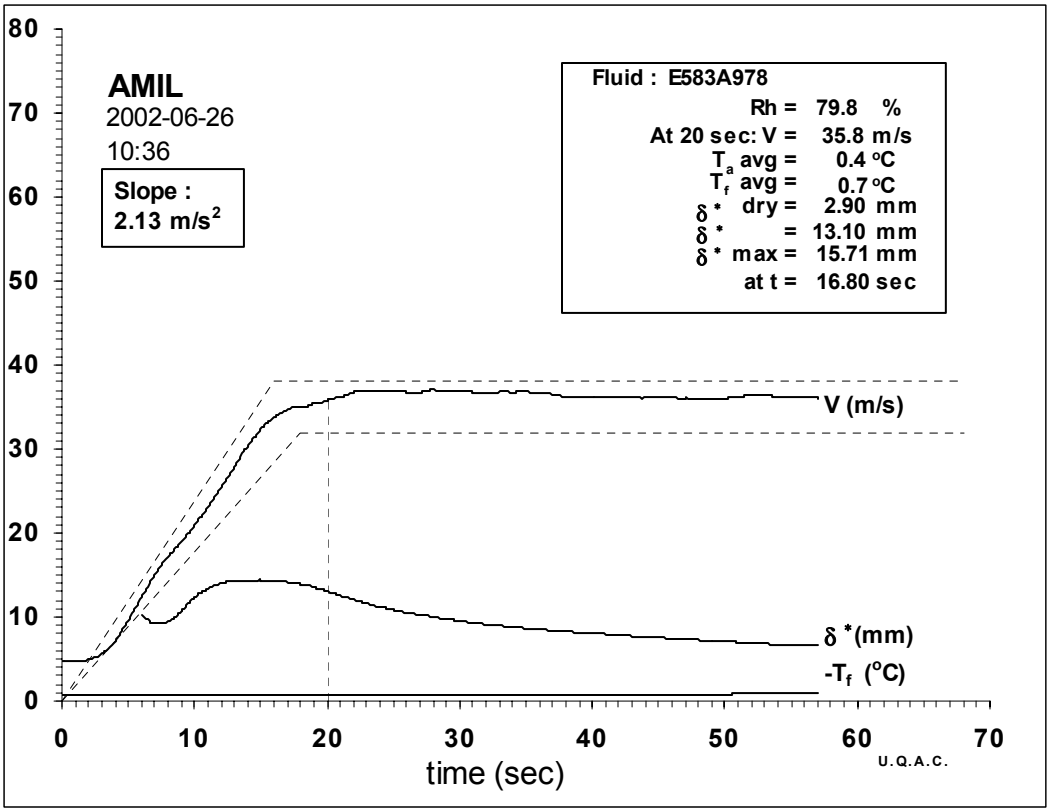
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.5	0.5	76.9	3.07	34.6	0.70	13.26
20	-0.5	0.5	77.0	3.36	36.2	0.73	12.89
21	-0.5	0.5	75.3	3.28	35.7	0.68	12.50

Averages :

20	-0.5	**0.5**	76.5	3.27	35.7	0.71	**12.87**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



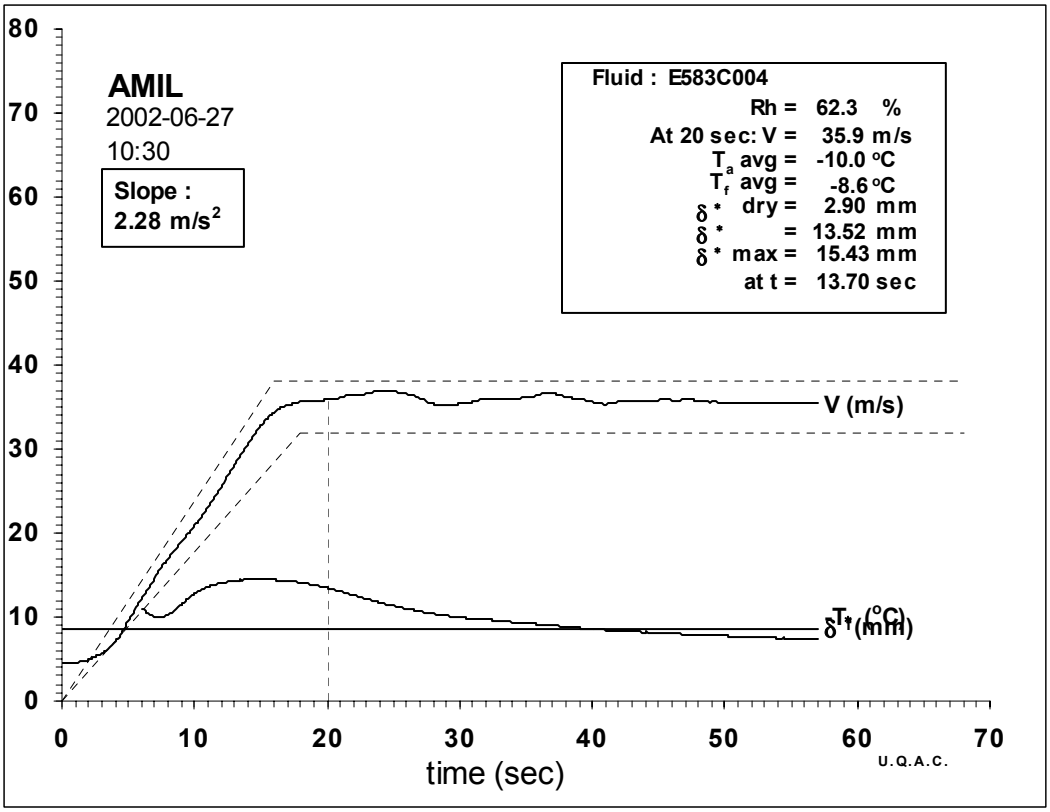
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.3	0.7	75.8	3.22	35.4	0.74	13.30
20	0.3	0.7	80.0	3.23	35.5	0.73	13.17
21	0.3	0.7	82.7	3.45	36.7	0.75	12.81

Averages :

20	0.3	**0.7**	79.8	3.29	35.8	0.74	**13.10**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



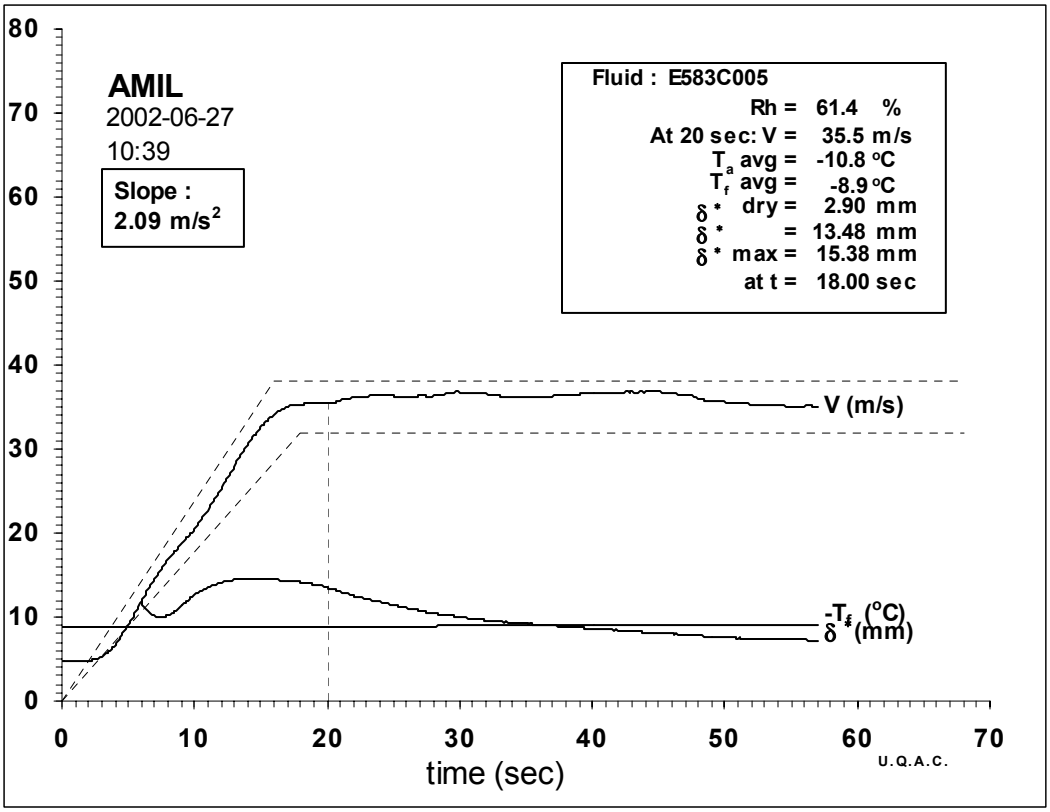
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-10.3	-8.6	62.5	3.28	35.1	0.80	13.86
20	-10.3	-8.6	62.1	3.48	36.1	0.83	13.59
21	-10.2	-8.6	62.5	3.50	36.3	0.79	13.12

Averages :

20	-10.3	**-8.6**	62.3	3.44	35.9	0.81	**13.52**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



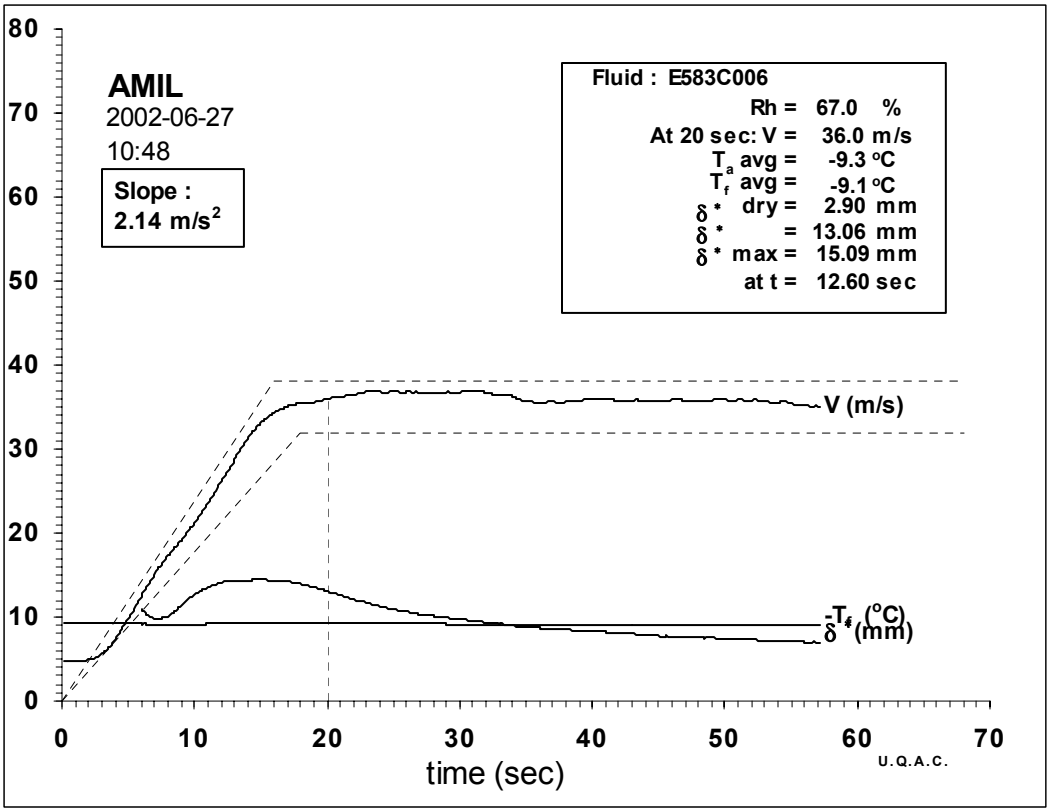
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-11.1	-8.9	61.9	3.42	35.8	0.84	13.92
20	-11.1	-8.9	61.6	3.33	35.3	0.79	13.54
21	-11.1	-8.9	60.6	3.40	35.7	0.75	13.01

Averages :

20	-11.1	**-8.9**	61.4	3.37	35.5	0.79	**13.48**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



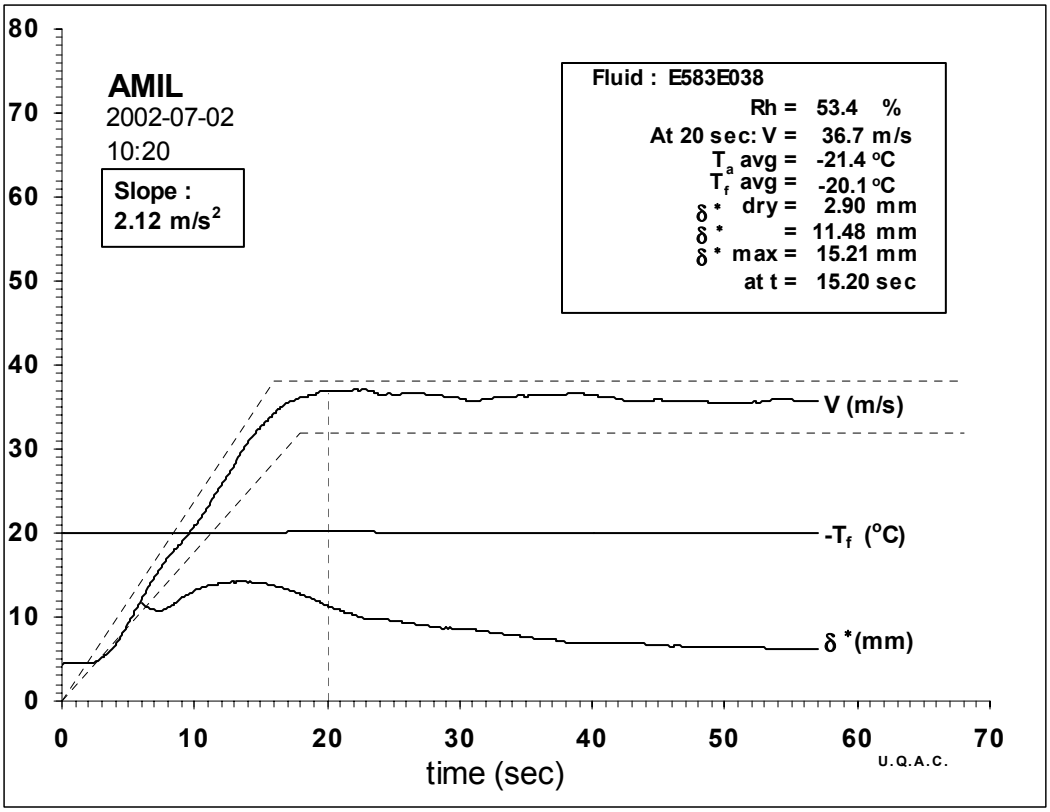
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-9.6	-9.2	68.4	3.51	36.3	0.83	13.54
20	-9.6	-9.2	66.2	3.36	35.6	0.75	13.04
21	-9.6	-9.2	67.3	3.54	36.5	0.75	12.68

Averages :

20	-9.6	**-9.2**	67.0	3.45	36.0	0.77	**13.06**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



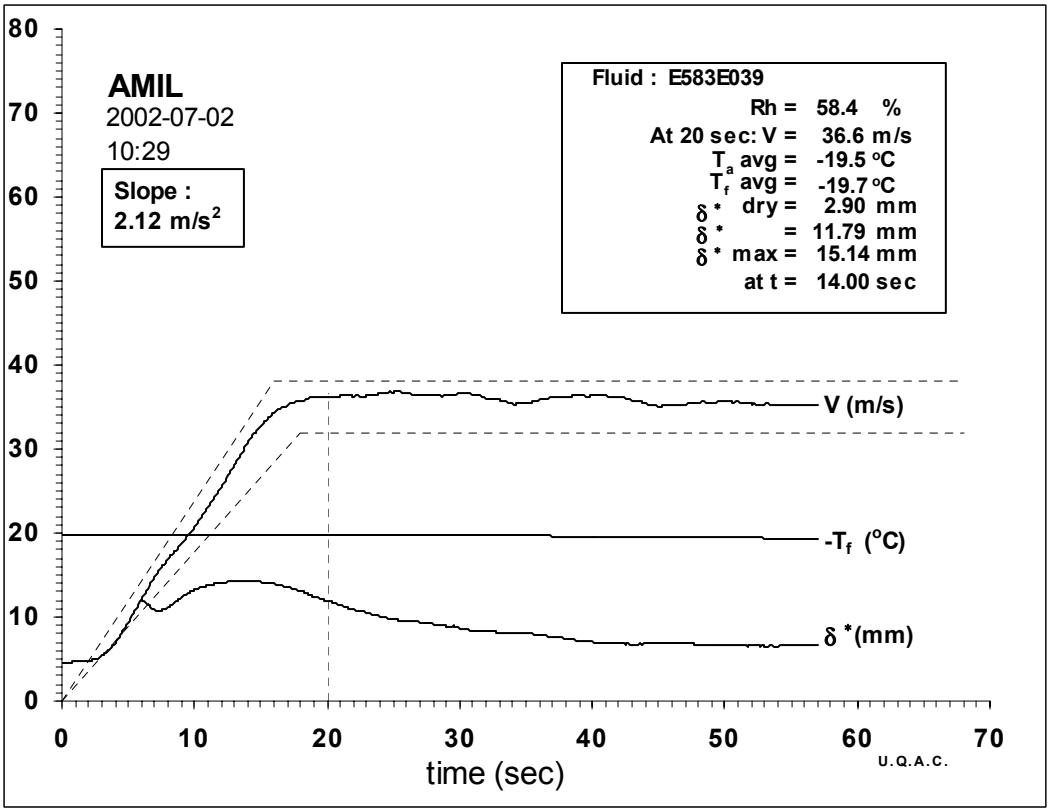
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-21.7	-20.1	55.7	3.66	36.3	0.69	11.79
20	-21.7	-20.1	51.3	3.73	36.6	0.69	11.64
21	-21.7	-20.1	55.0	3.82	37.1	0.64	10.95

Averages :

20	-21.7	**-20.1**	53.4	3.74	36.7	0.68	**11.48**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



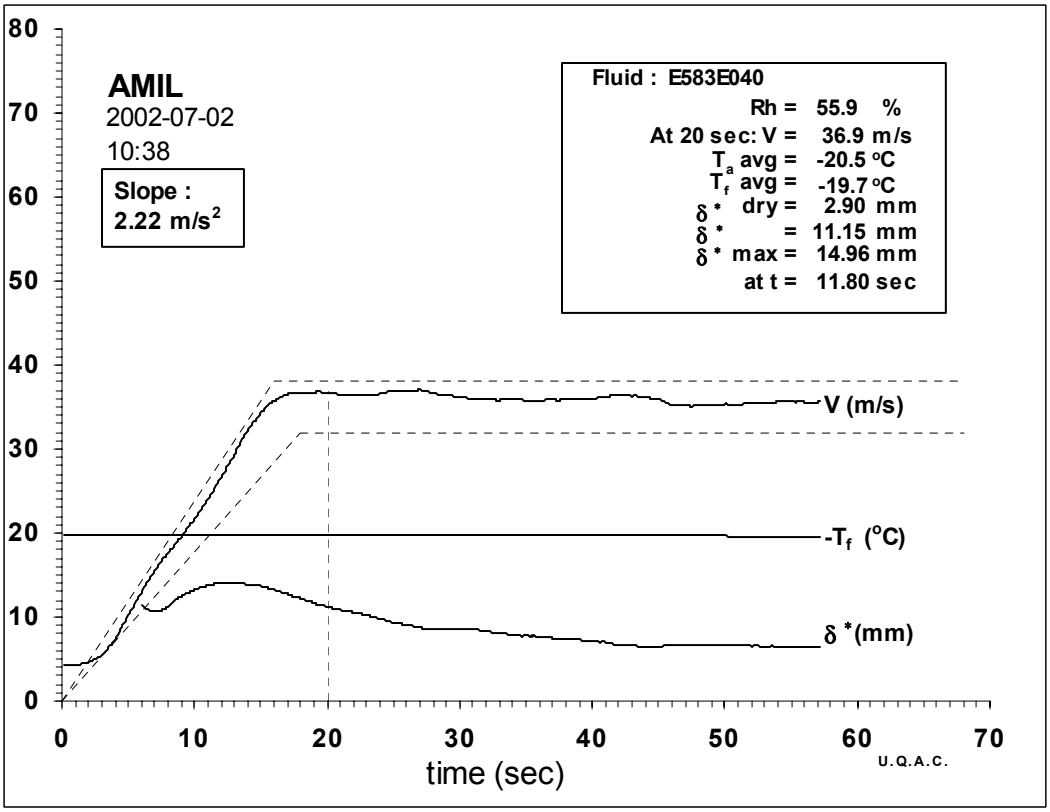
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-19.8	-19.8	61.7	3.66	36.4	0.75	12.39
20	-19.8	-19.8	57.3	3.77	37.0	0.73	11.93
21	-19.8	-19.8	57.6	3.65	36.3	0.62	11.07

Averages :

20	-19.8	**-19.8**	58.4	3.71	36.6	0.70	**11.79**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-20.8	-19.8	54.9	3.81	37.0	0.68	11.33
20	-20.8	-19.7	55.4	3.76	36.8	0.66	11.20
21	-20.8	-19.8	57.6	3.77	36.9	0.63	10.92

Averages :

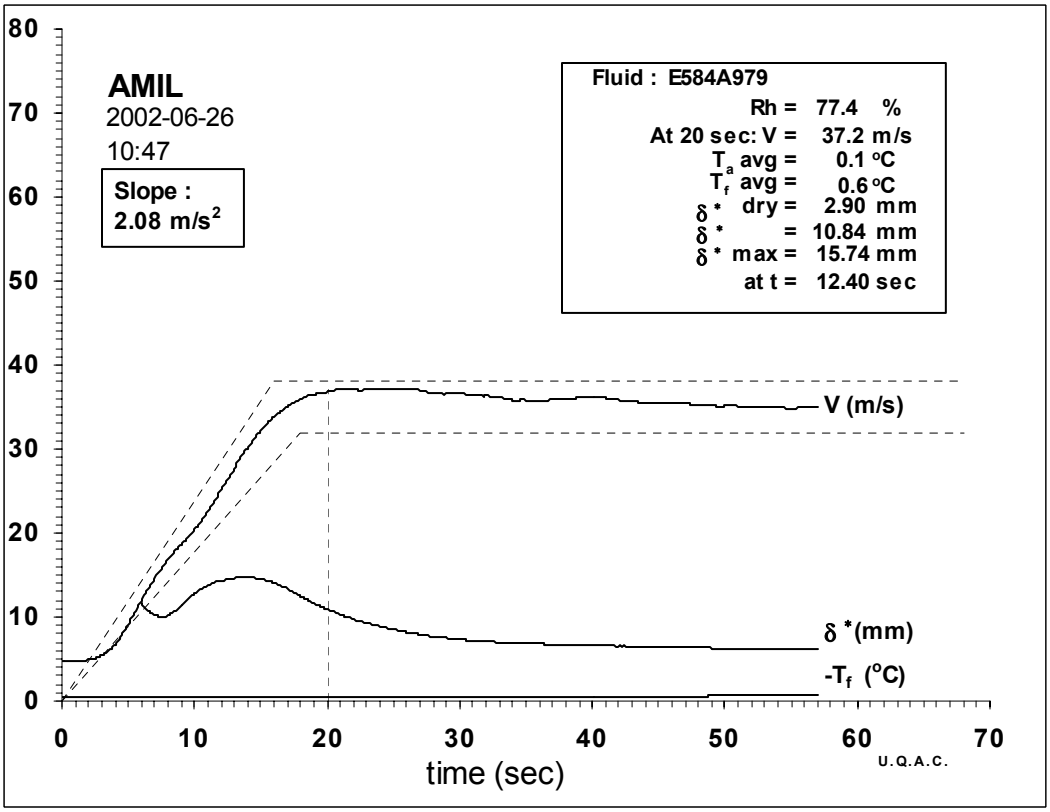
20	-20.8	**-19.7**	55.9	3.77	36.9	0.66	**11.15**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.12 OCTAGON MAXFLIGHT, LOT F-23195C, 75/25 DILUTION E-584.

FP-979



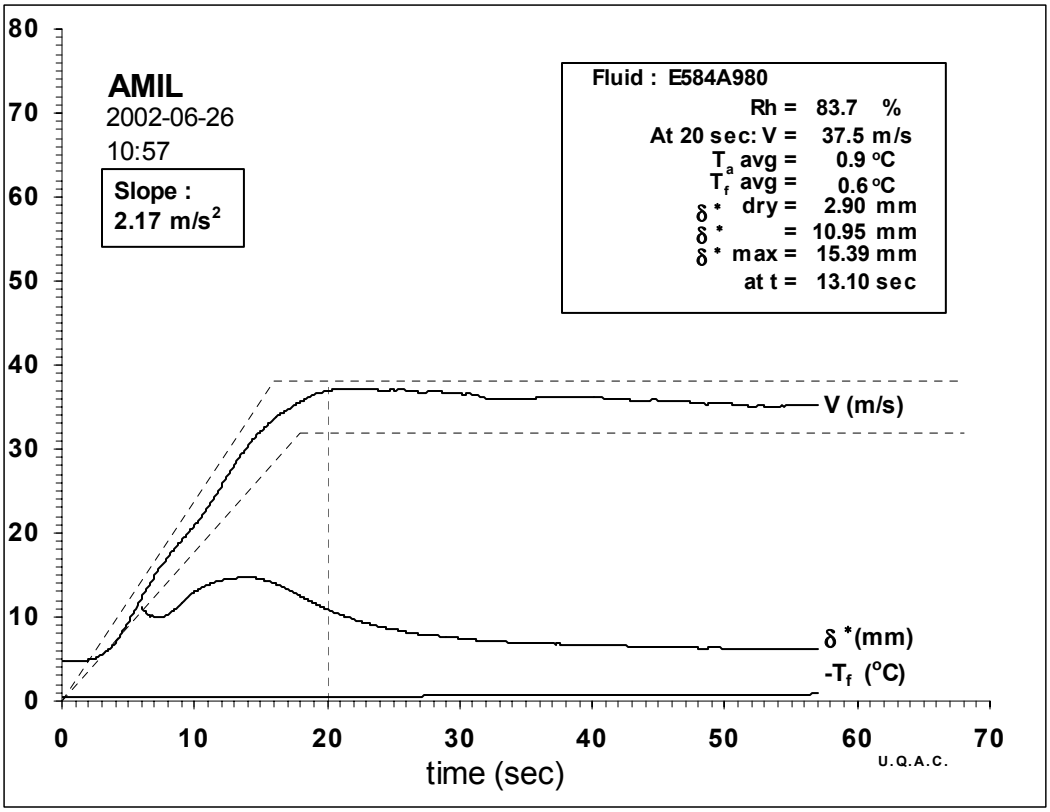
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.0	0.5	77.6	3.48	36.8	0.62	11.31
20	0.0	0.5	77.5	3.58	37.4	0.61	11.02
21	0.0	0.6	76.9	3.52	37.0	0.52	10.13

Averages :

20	0.0	**0.5**	77.4	3.54	37.2	0.59	**10.84**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



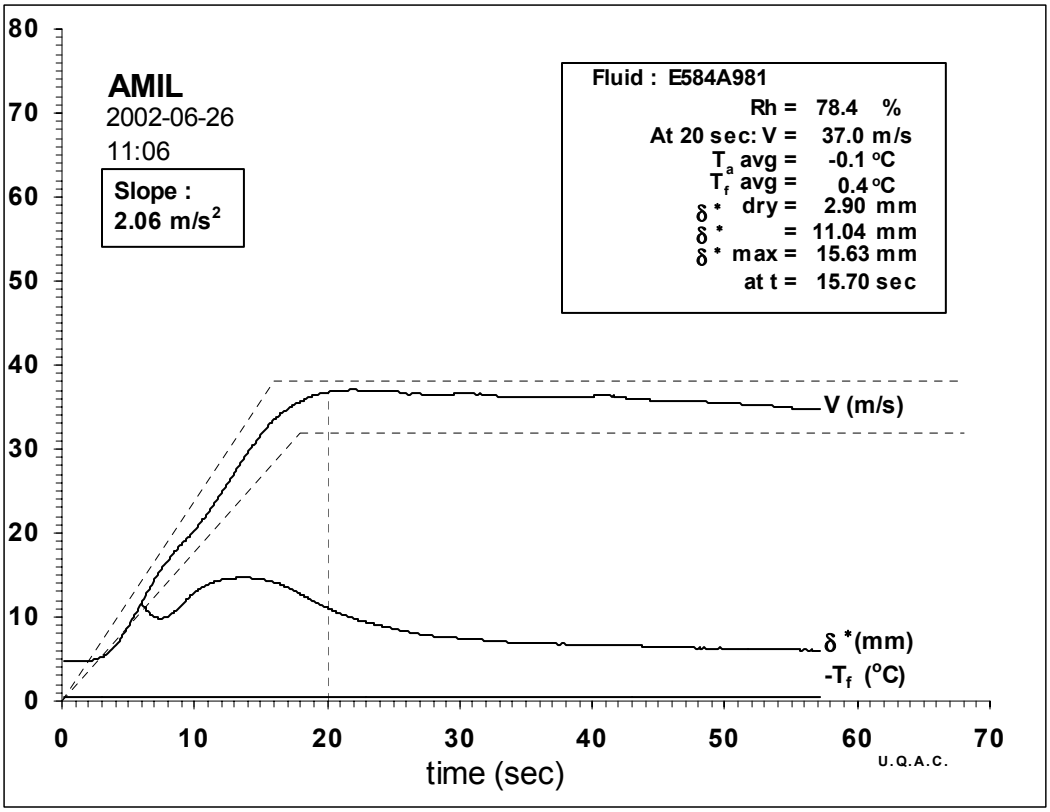
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.7	0.5	86.0	3.48	36.9	0.64	11.51
20	0.8	0.6	81.2	3.59	37.5	0.61	10.95
21	0.8	0.6	86.0	3.66	37.9	0.58	10.50

Averages :

20	0.8	**0.6**	83.7	3.59	37.5	0.61	**10.95**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



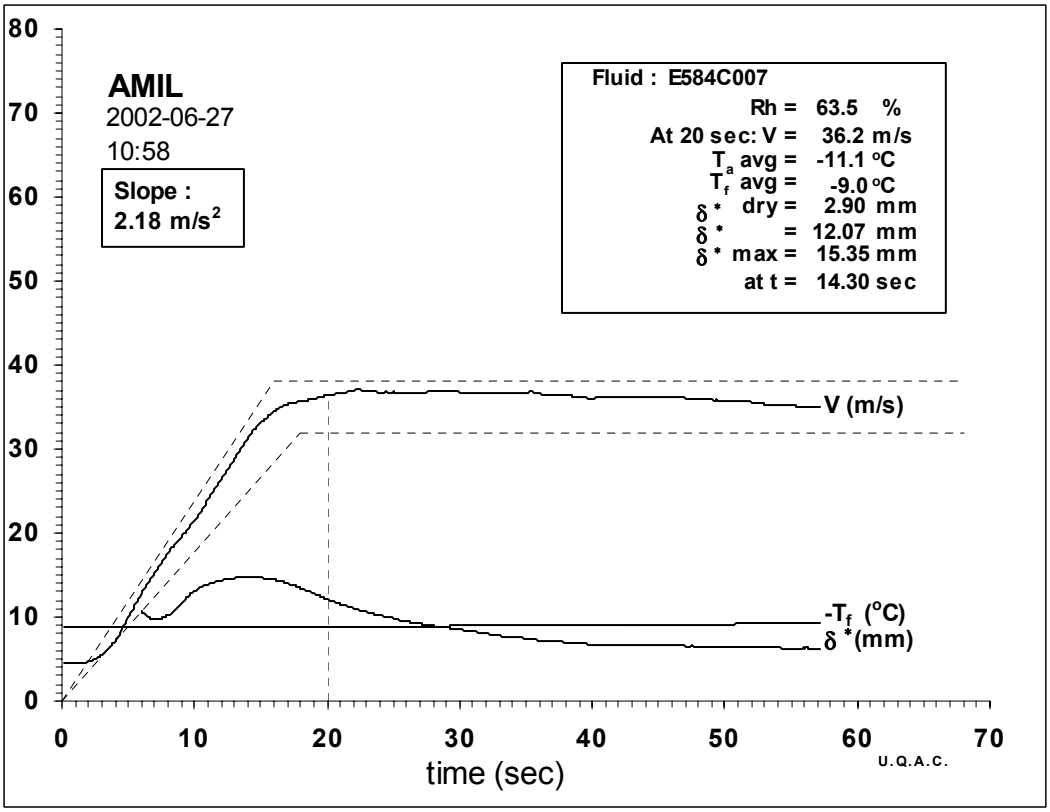
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.3	0.4	76.4	3.53	37.1	0.66	11.68
20	-0.3	0.4	79.2	3.51	37.0	0.60	11.01
21	-0.3	0.4	78.9	3.53	37.1	0.56	10.55

Averages :

20	-0.3	**0.4**	78.4	3.52	37.0	0.60	**11.04**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



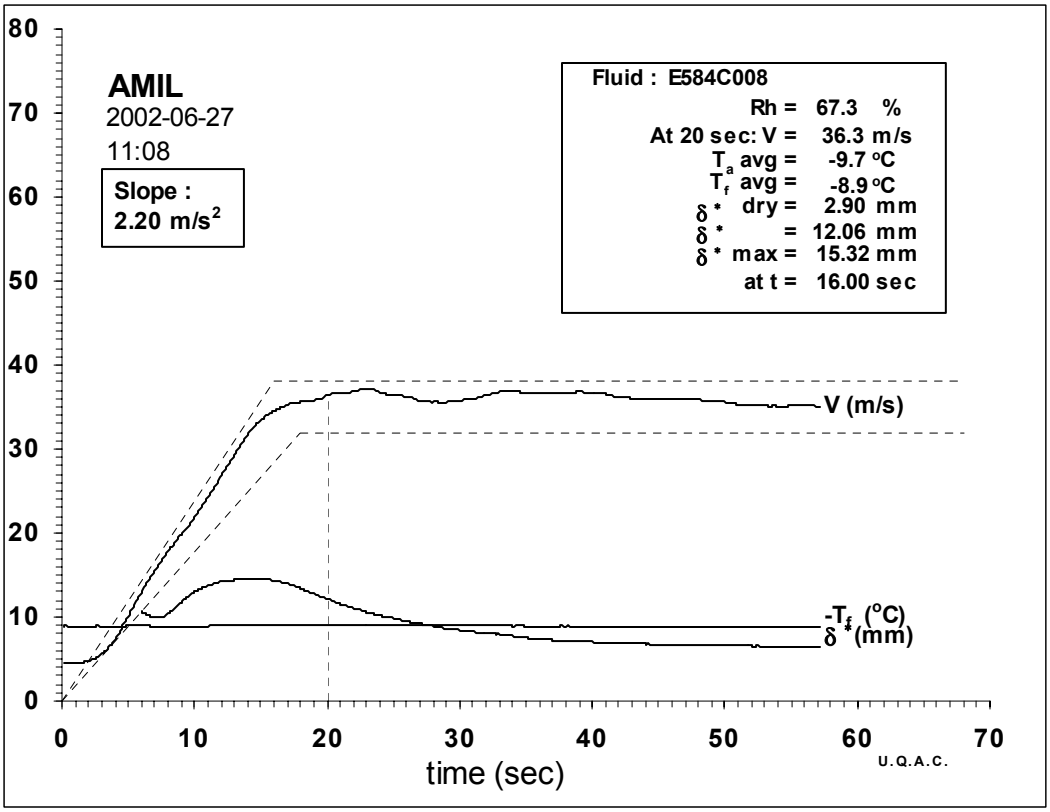
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-11.4	-8.8	62.4	3.42	35.8	0.73	12.63
20	-11.4	-8.8	65.3	3.48	36.1	0.69	12.13
21	-11.5	-8.9	61.5	3.59	36.6	0.66	11.52

Averages :

20	-11.5	**-8.8**	63.5	3.50	36.2	0.69	**12.07**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



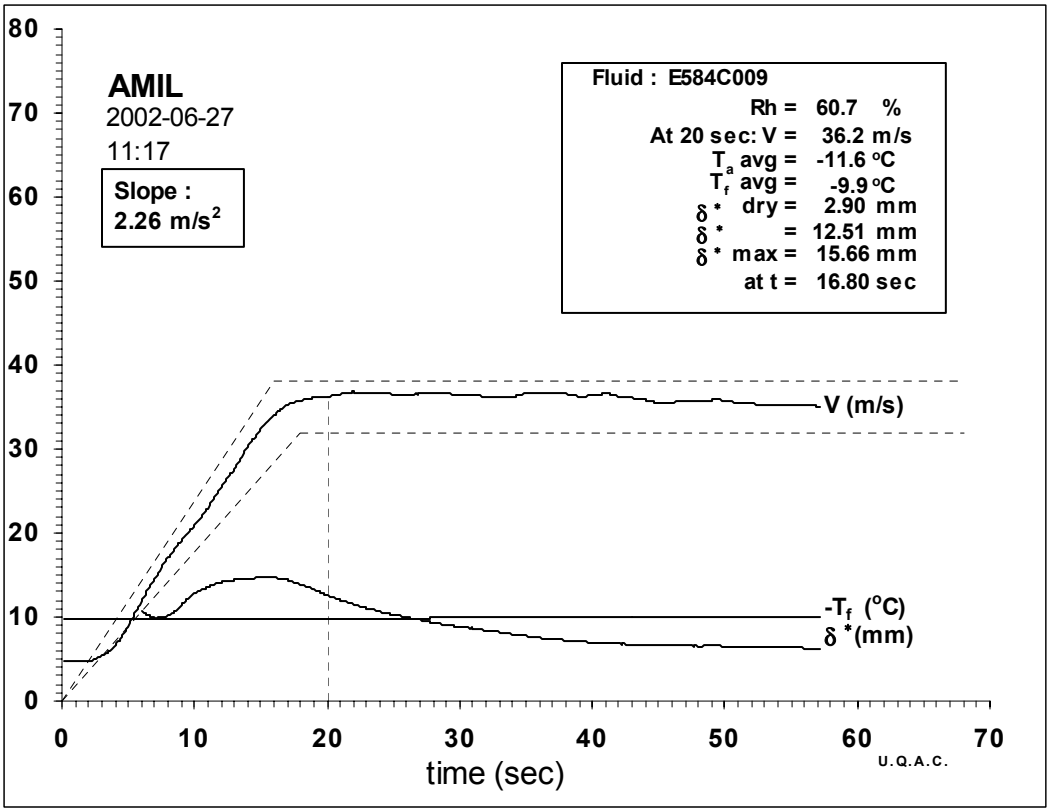
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.0	-8.9	67.5	3.51	36.4	0.75	12.70
20	-10.0	-8.9	66.9	3.49	36.2	0.68	12.01
21	-10.0	-8.9	67.8	3.49	36.3	0.65	11.62

Averages :

20	-10.0	**-8.9**	67.3	3.50	36.3	0.69	**12.06**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



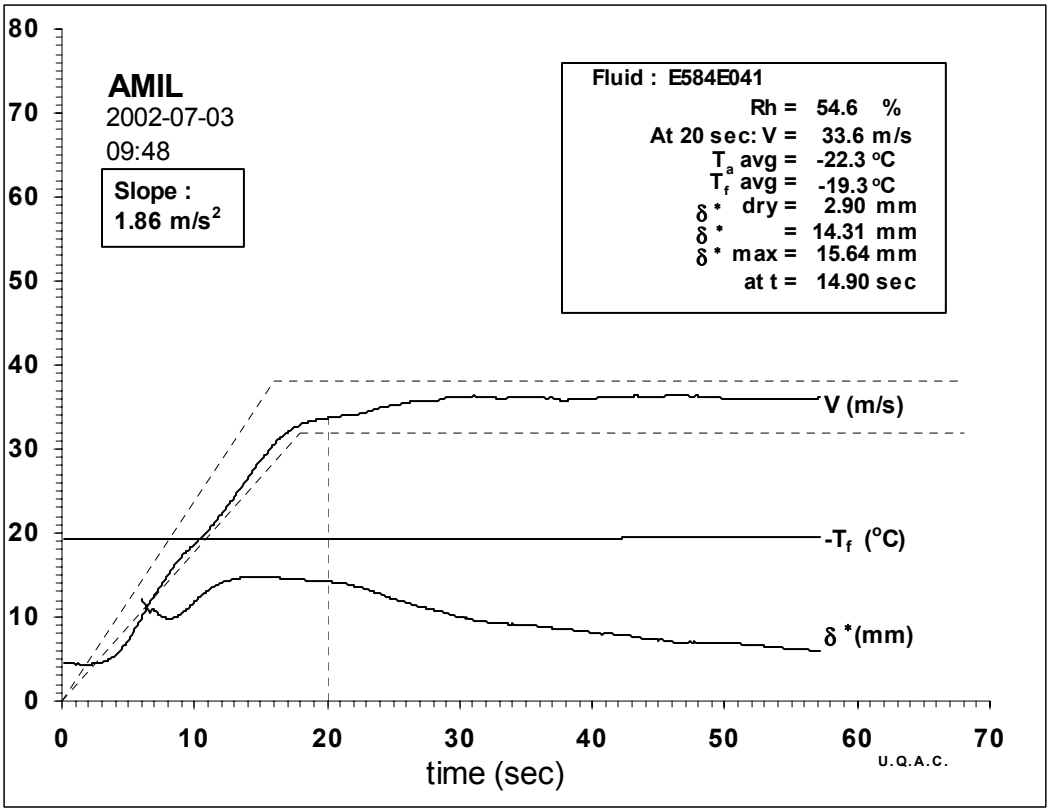
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-12.0	-9.8	59.1	3.39	35.6	0.75	12.96
20	-11.9	-9.8	59.9	3.62	36.7	0.76	12.54
21	-11.9	-9.8	63.3	3.45	35.9	0.68	12.09

Averages :

20	-11.9	**-9.8**	60.7	3.51	36.2	0.73	**12.51**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



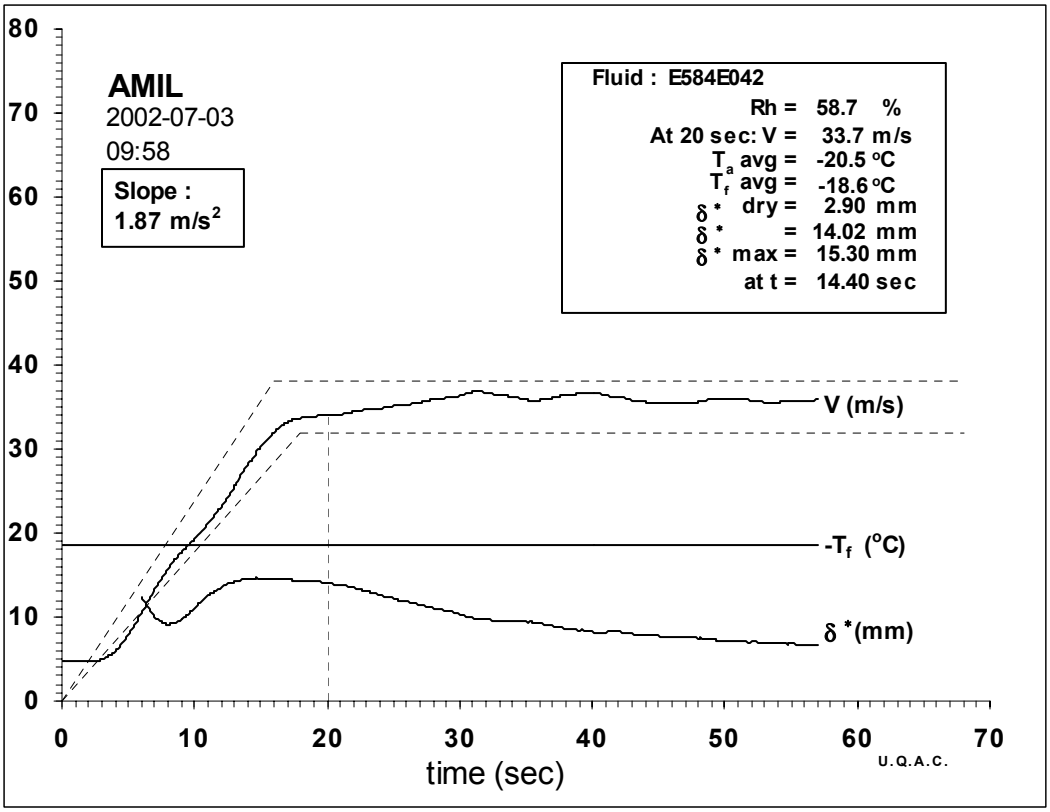
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-22.7	-19.3	57.7	3.14	33.5	0.81	14.31
20	-22.7	-19.3	51.5	3.21	33.9	0.82	14.26
21	-22.6	-19.3	57.2	3.09	33.3	0.80	14.39

Averages :

20	-22.6	**-19.3**	54.6	3.16	33.6	0.81	**14.31**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



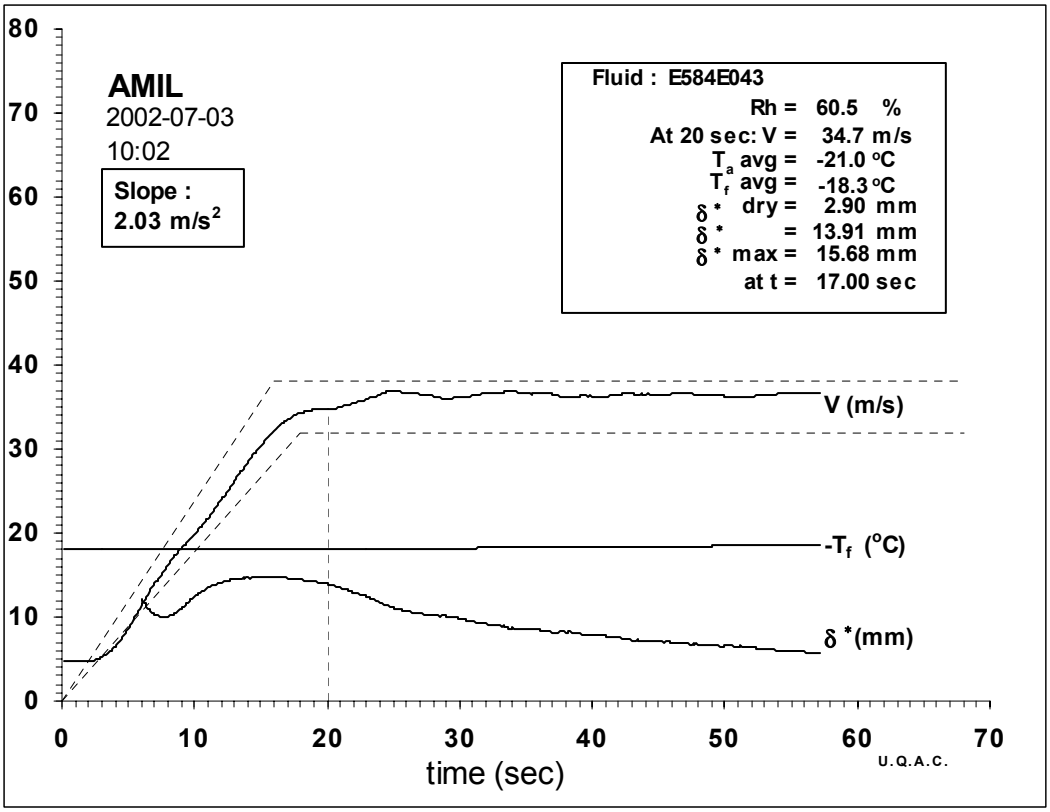
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-20.7	-18.6	56.9	3.12	33.6	0.76	13.83
20	-20.7	-18.6	57.0	3.11	33.5	0.79	14.13
21	-20.7	-18.6	62.9	3.21	34.0	0.80	13.99

Averages :

20	-20.7	**-18.6**	58.7	3.14	33.7	0.78	**14.02**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-18.2	60.9	3.38	34.9	0.85	14.09
20	-21.3	-18.2	60.3	3.36	34.8	0.84	14.01
21	-21.4	-18.2	60.5	3.27	34.3	0.78	13.61

Averages :

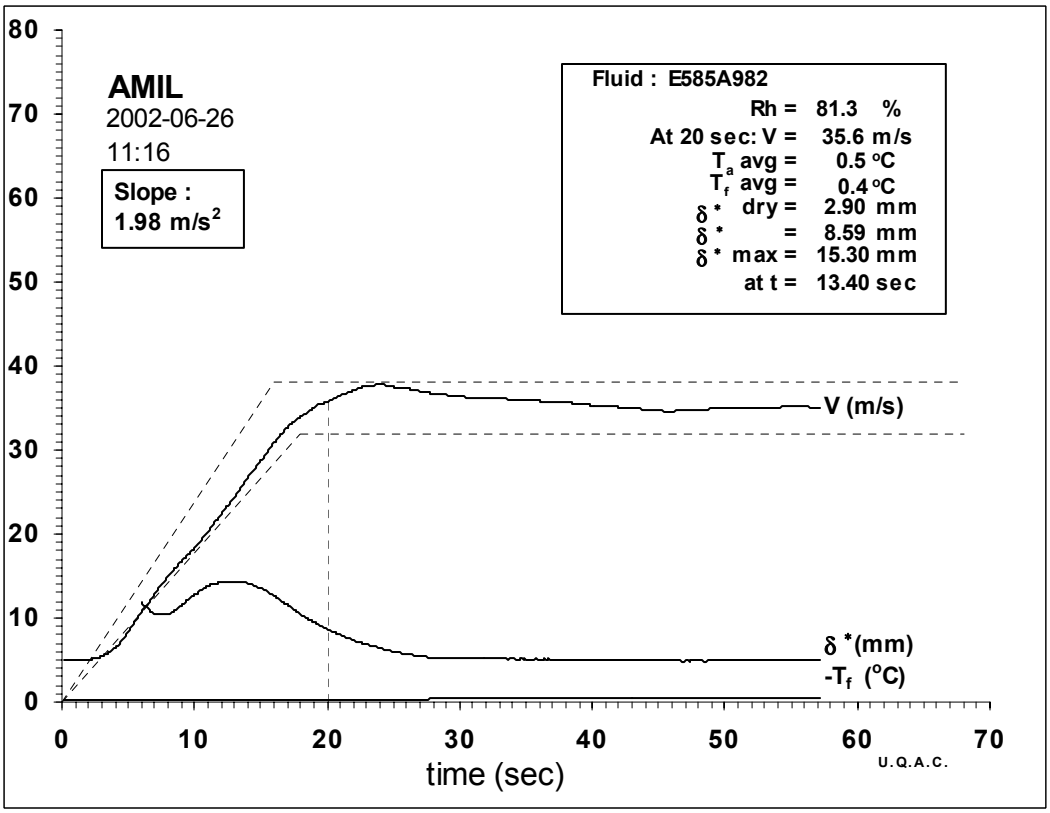
20	-21.3	**-18.2**	60.5	3.34	34.7	0.82	**13.91**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.13 OCTAGON MAXFLIGHT, LOT F-23195C, 50/50 DILUTION E-585.

FP-982



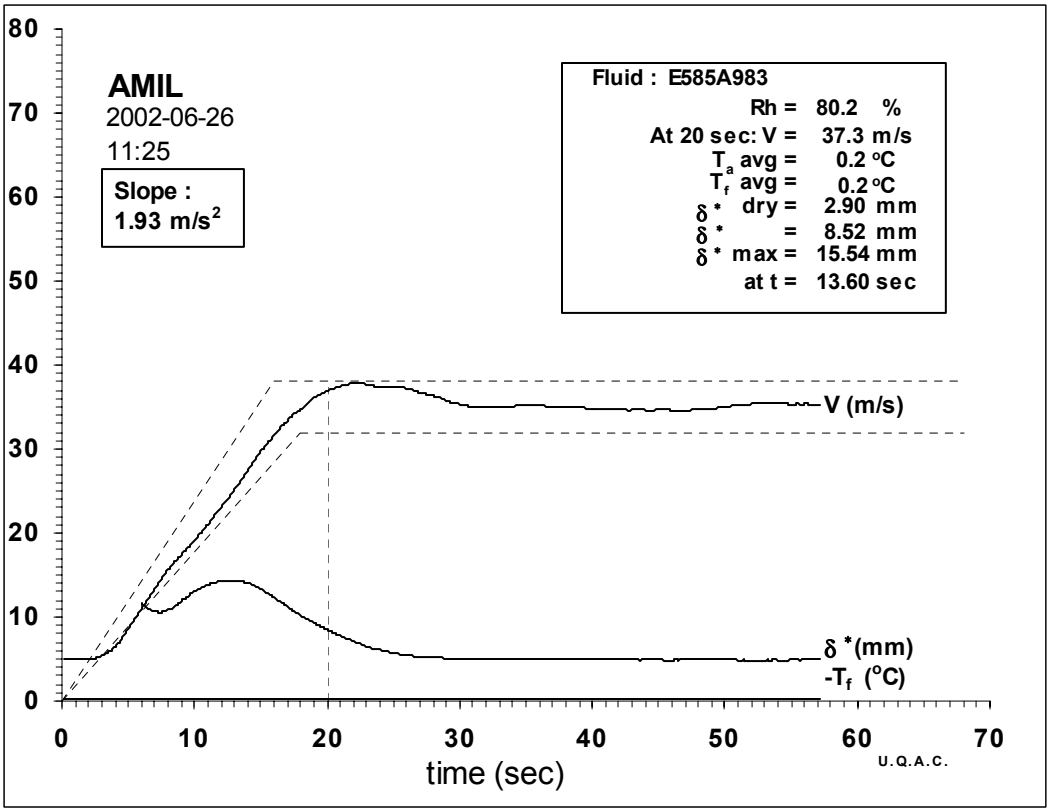
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.4	0.3	77.4	3.14	35.0	0.40	9.26
20	0.4	0.3	83.4	3.22	35.5	0.35	8.47
21	0.4	0.3	80.9	3.36	36.2	0.35	8.24

Averages :

20	0.4	**0.3**	81.3	3.24	35.6	0.36	**8.59**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



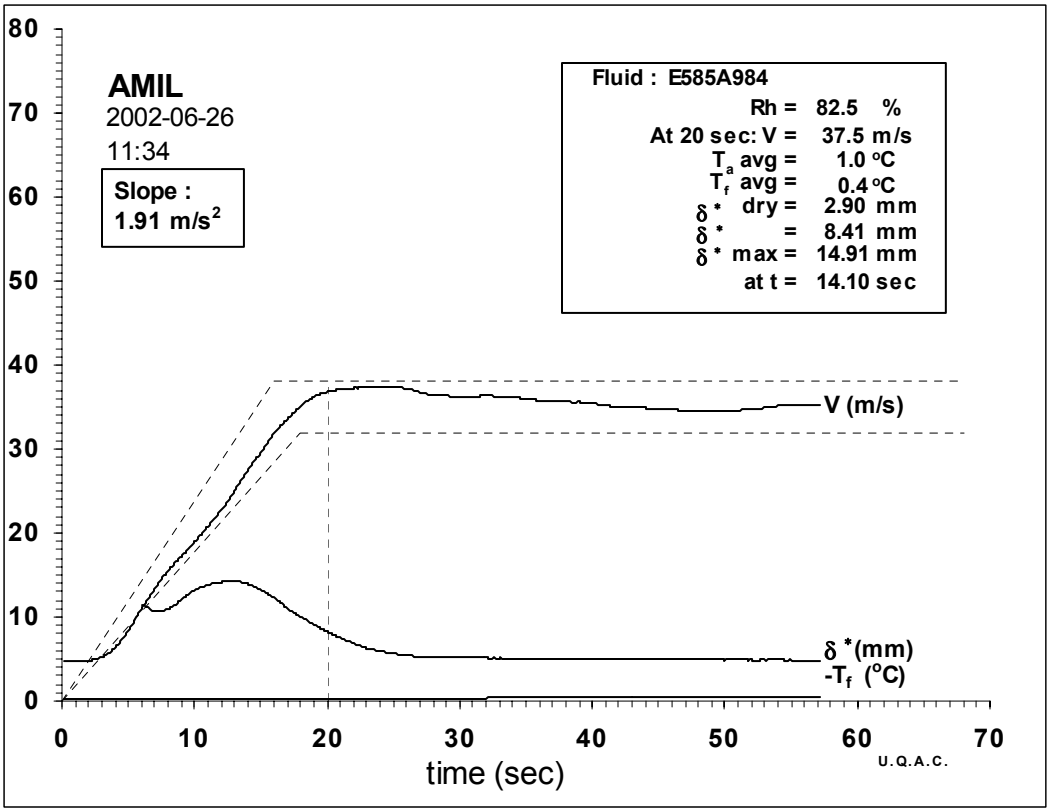
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.1	0.2	78.5	3.26	35.7	0.40	8.99
20	0.1	0.2	79.8	3.52	37.1	0.39	8.49
21	0.1	0.2	82.3	3.87	38.9	0.40	8.20

Averages :

20	0.1	**0.2**	80.2	3.56	37.3	0.39	**8.52**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



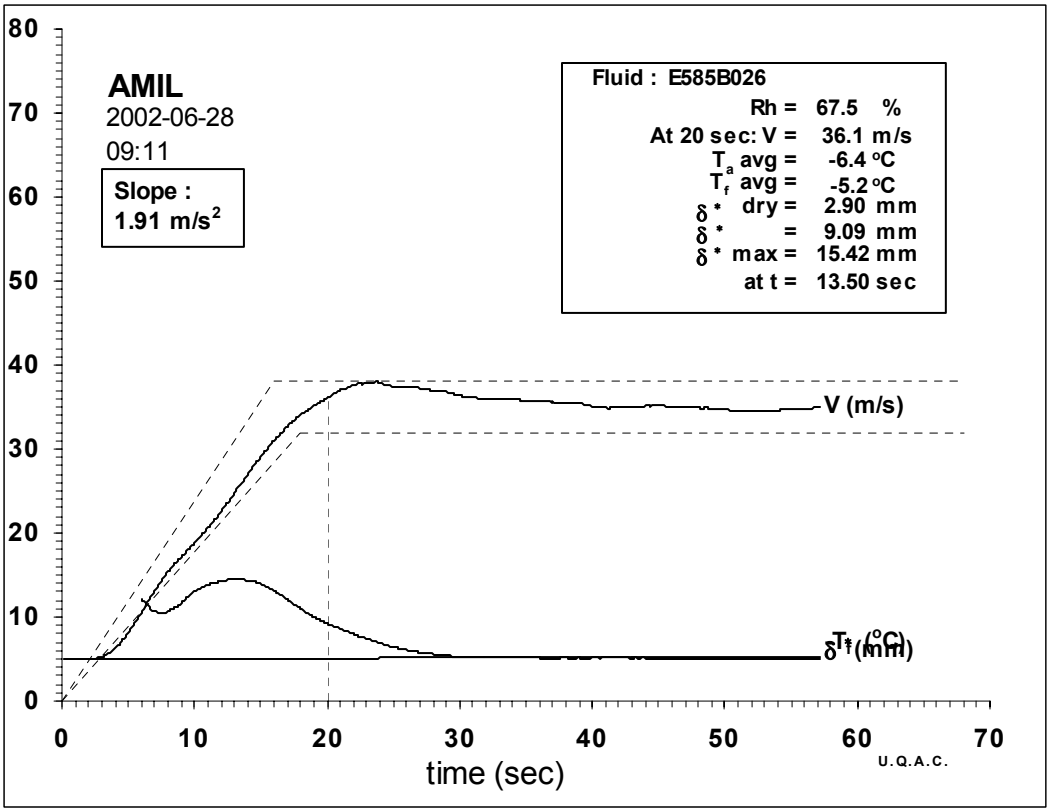
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.9	0.3	78.7	3.52	37.1	0.43	9.01
20	0.9	0.3	84.9	3.62	37.7	0.39	8.40
21	0.9	0.3	81.8	3.60	37.6	0.35	7.94

Averages :

20	0.9	**0.3**	82.5	3.59	37.5	0.39	**8.41**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



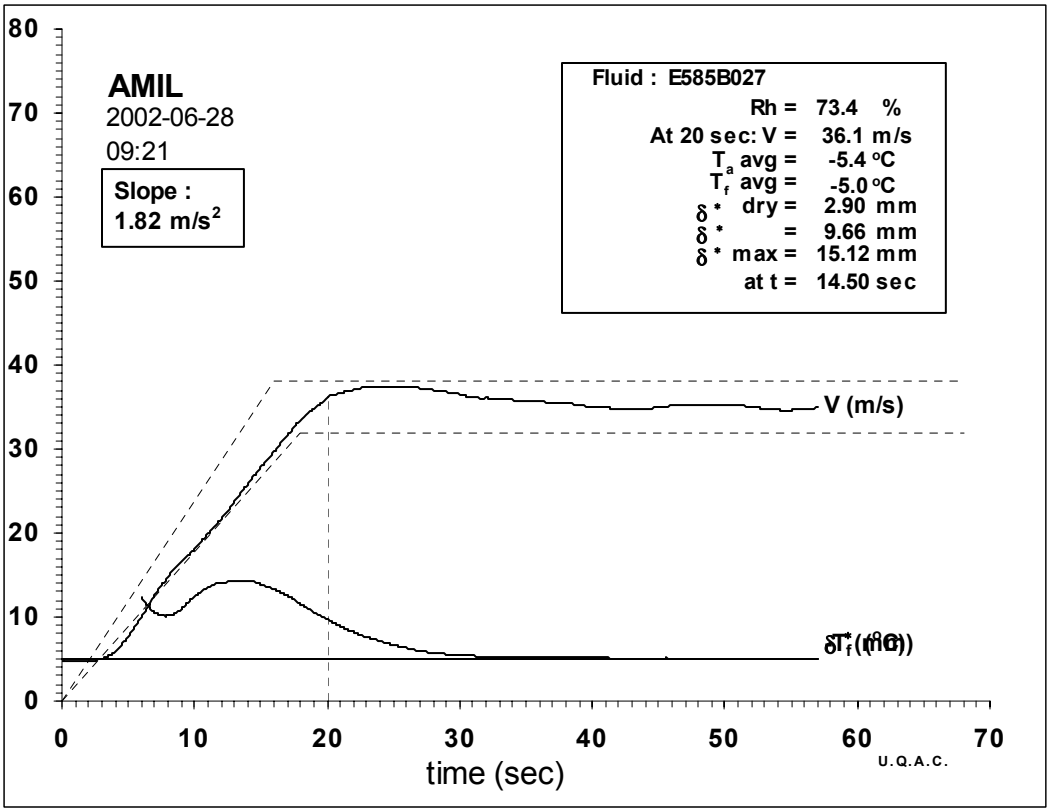
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-6.7	-5.1	68.7	3.28	35.3	0.44	9.57
20	-6.6	-5.1	66.5	3.36	35.7	0.43	9.25
21	-6.6	-5.0	68.0	3.67	37.4	0.40	8.42

Averages :

20	-6.6	**-5.1**	67.5	3.43	36.1	0.42	**9.09**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



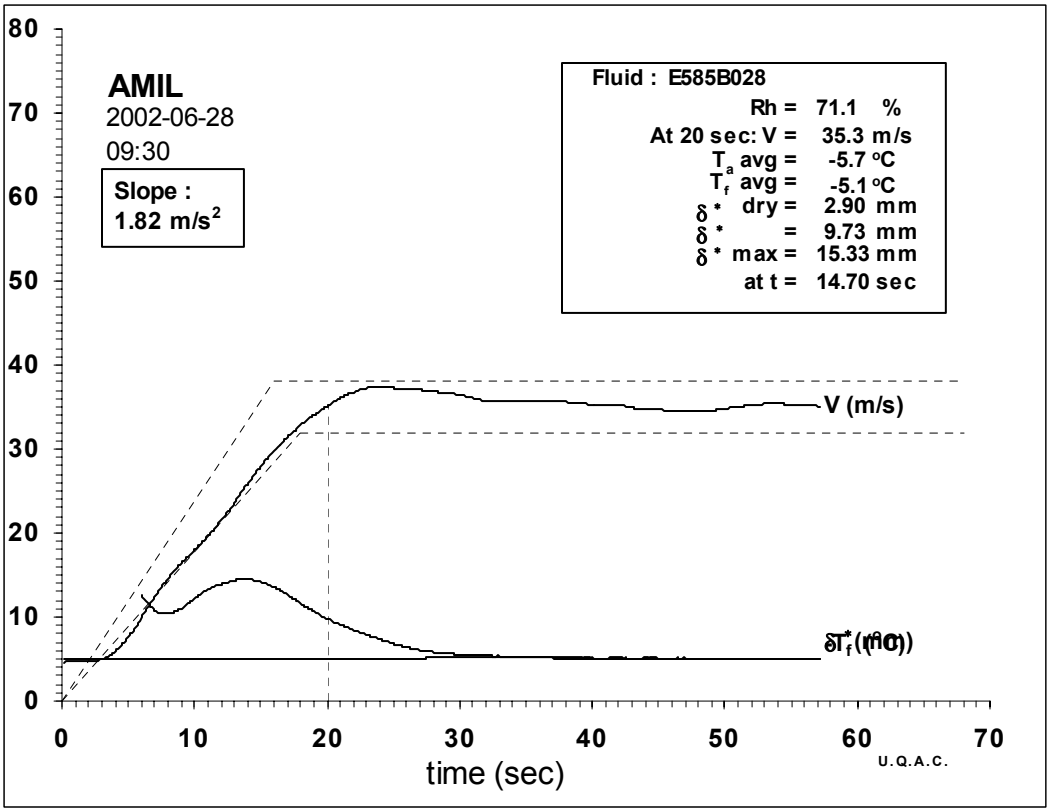
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-5.6	-5.0	72.1	3.40	36.1	0.54	10.58
20	-5.5	-5.0	74.0	3.44	36.3	0.48	9.70
21	-5.5	-5.0	73.5	3.39	36.0	0.40	8.81

Averages :

20	-5.6	**-5.0**	73.4	3.42	36.1	0.47	**9.66**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



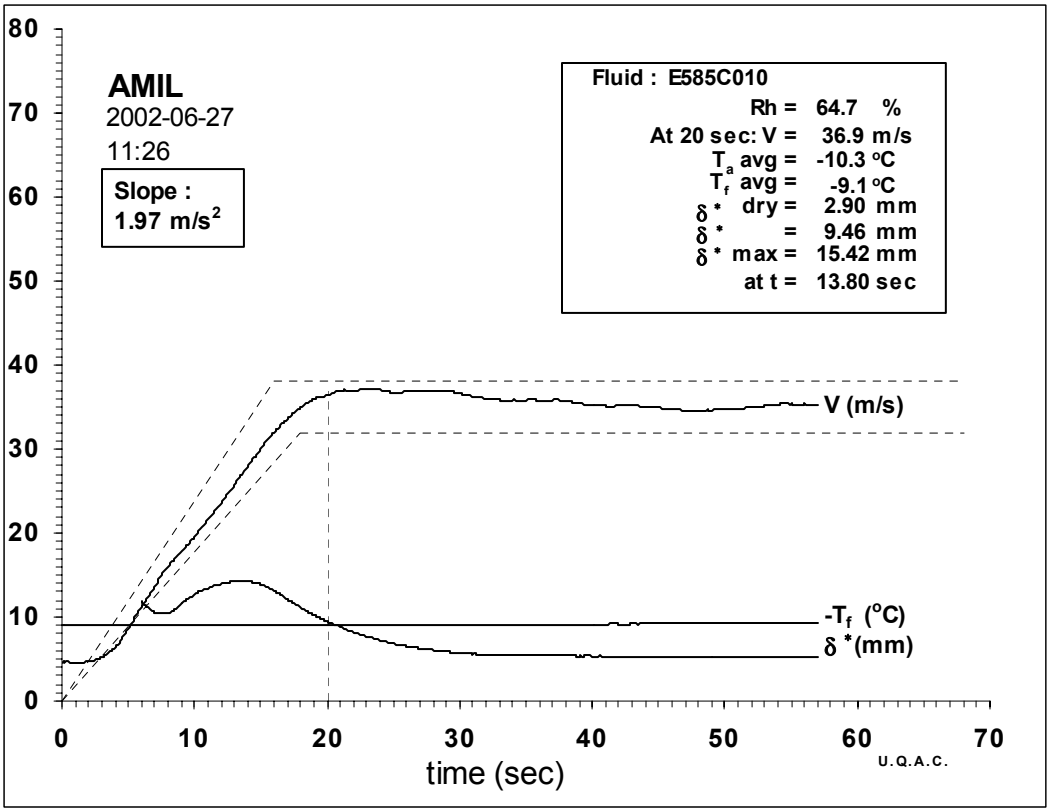
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-5.9	-5.1	69.7	3.01	33.9	0.45	10.14
20	-5.9	-5.1	71.7	3.32	35.6	0.47	9.87
21	-5.9	-5.1	71.1	3.39	36.0	0.42	9.16

Averages :

20	-5.9	**-5.1**	71.1	3.27	35.3	0.45	**9.73**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



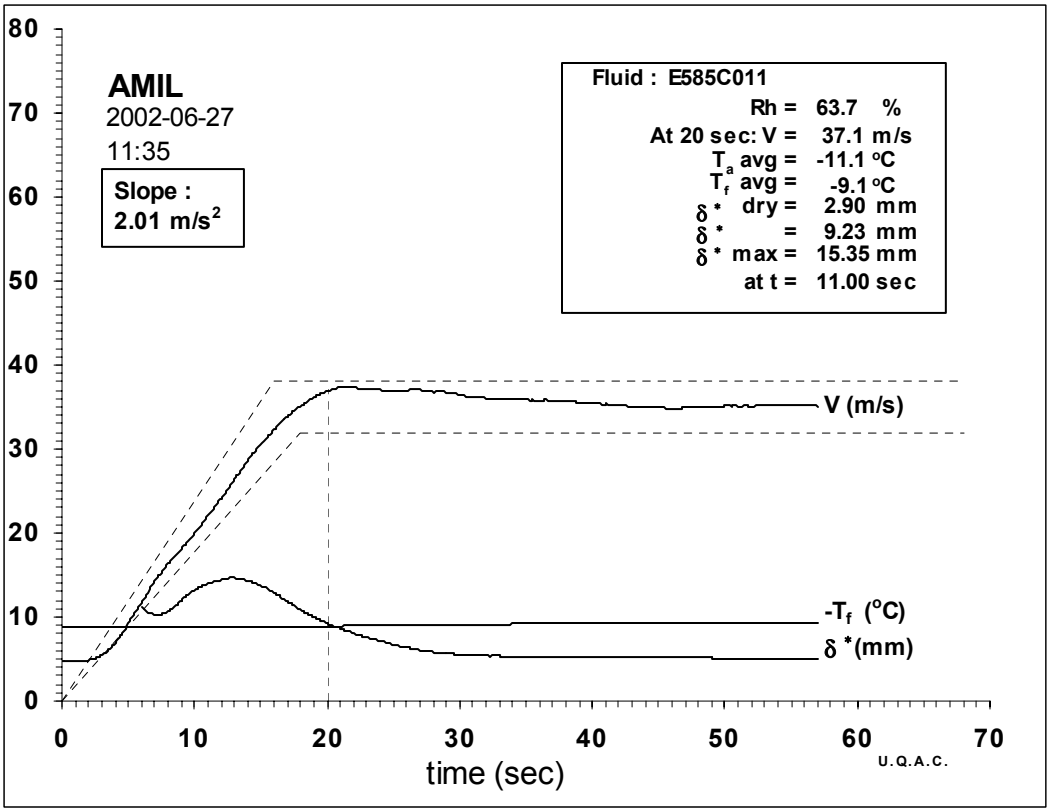
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.6	-9.0	64.6	3.47	36.1	0.51	10.08
20	-10.6	-9.0	64.7	3.64	36.9	0.48	9.45
21	-10.5	-9.0	64.8	3.72	37.4	0.45	8.97

Averages :

20	-10.5	**-9.0**	64.7	3.62	36.9	0.48	**9.46**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



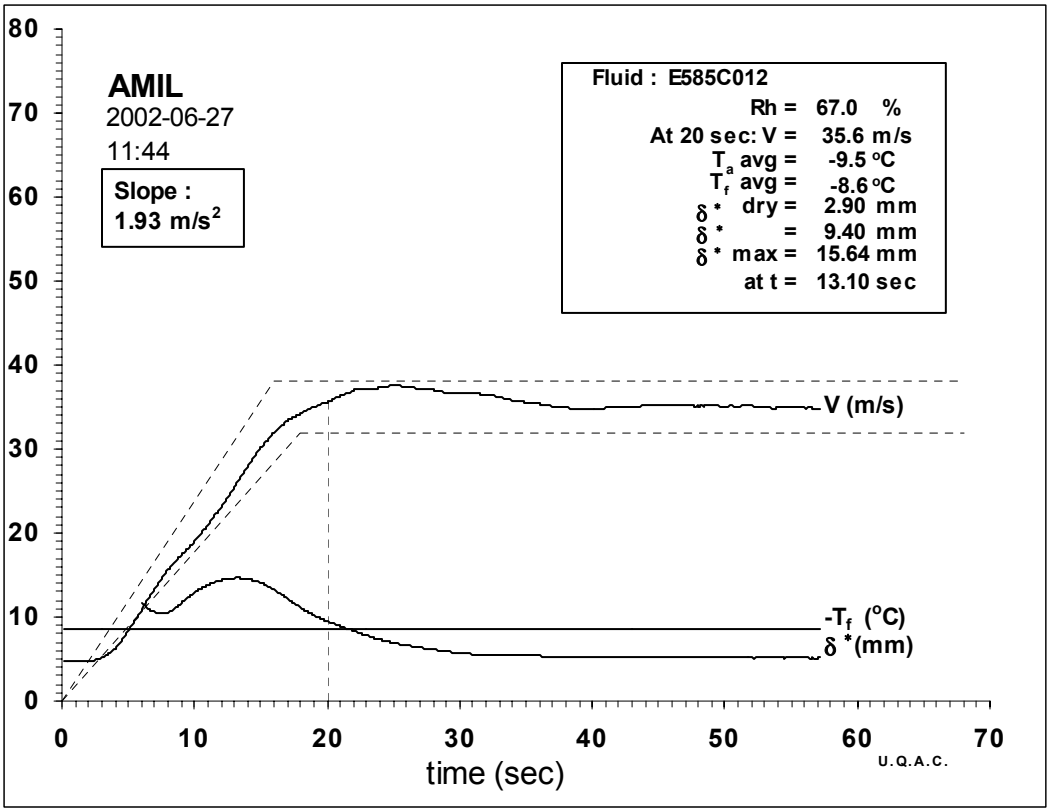
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-11.4	-8.9	63.1	3.68	37.1	0.51	9.74
20	-11.3	-8.9	62.8	3.65	37.0	0.46	9.20
21	-11.3	-8.9	65.7	3.73	37.3	0.44	8.87

Averages :

20	-11.4	**-8.9**	63.7	3.68	37.1	0.47	**9.23**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-9.8	-8.5	67.9	3.20	34.7	0.45	9.76
20	-9.8	-8.5	67.7	3.33	35.4	0.44	9.50
21	-9.8	-8.5	65.2	3.57	36.7	0.43	8.93

Averages :

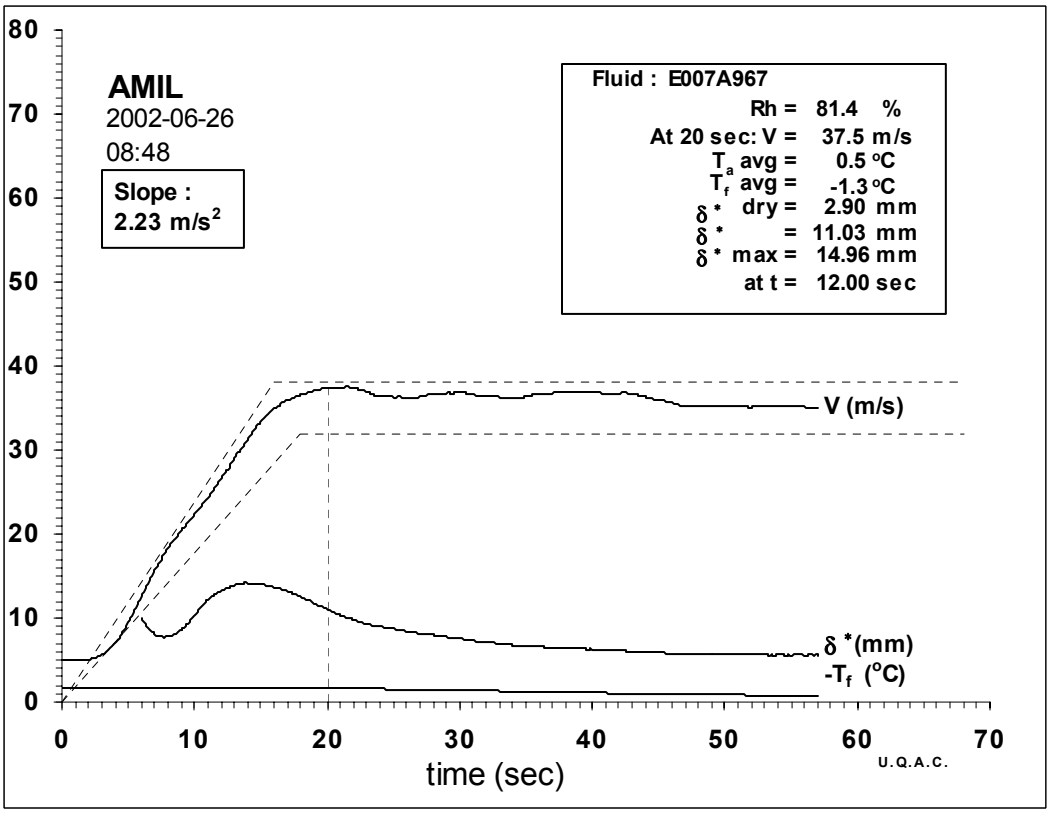
20	-9.8	**-8.5**	67.0	3.37	35.6	0.44	**9.40**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.14 SPCA AD-480, LOT M052, NEAT E-007.

FP-967



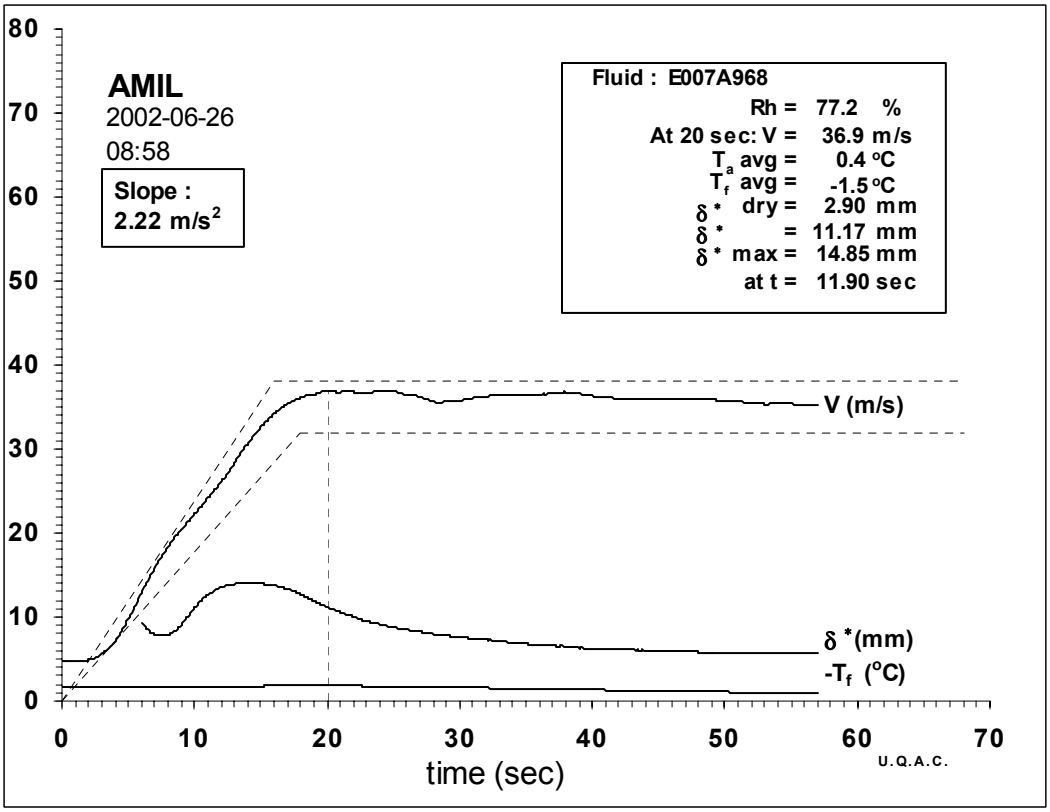
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.4	-1.6	81.6	3.38	36.3	0.63	11.63
20	0.4	-1.6	79.6	3.63	37.7	0.62	11.06
21	0.4	-1.6	84.3	3.76	38.3	0.59	10.49

Averages :

20	0.4	**-1.6**	81.4	3.61	37.5	0.61	**11.03**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



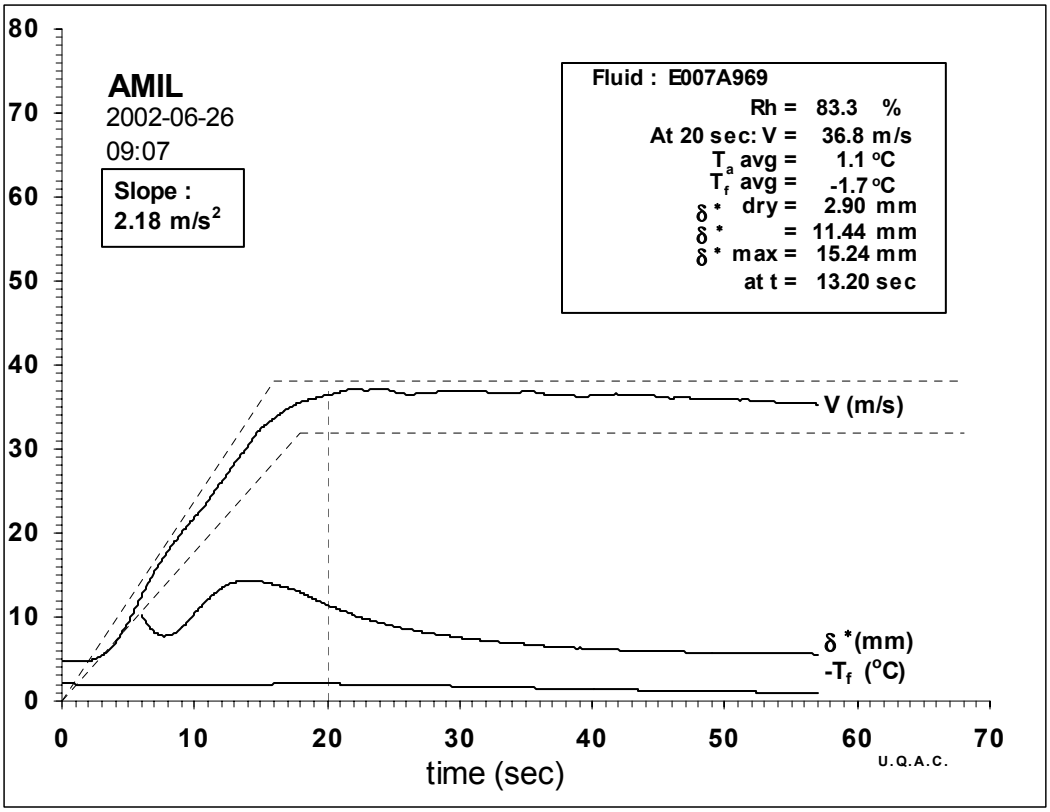
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.3	-1.8	78.5	3.40	36.4	0.63	11.66
20	0.3	-1.8	77.1	3.51	37.0	0.62	11.25
21	0.3	-1.8	76.4	3.54	37.2	0.57	10.63

Averages :

20	0.3	**-1.8**	77.2	3.49	36.9	0.61	**11.17**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



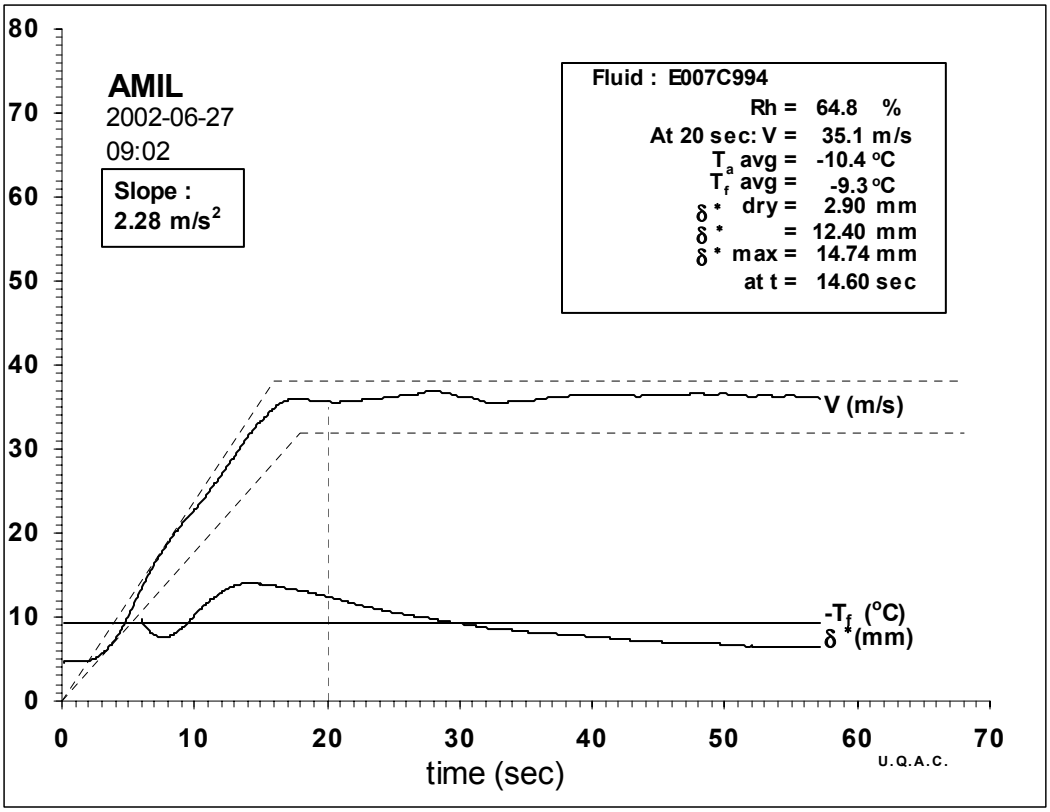
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	1.1	-2.0	85.3	3.32	36.1	0.64	11.92
20	1.1	-2.0	82.4	3.51	37.1	0.64	11.49
21	1.1	-2.0	83.1	3.46	36.8	0.59	10.96

Averages :

20	1.1	**-2.0**	83.3	3.45	36.8	0.62	**11.44**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



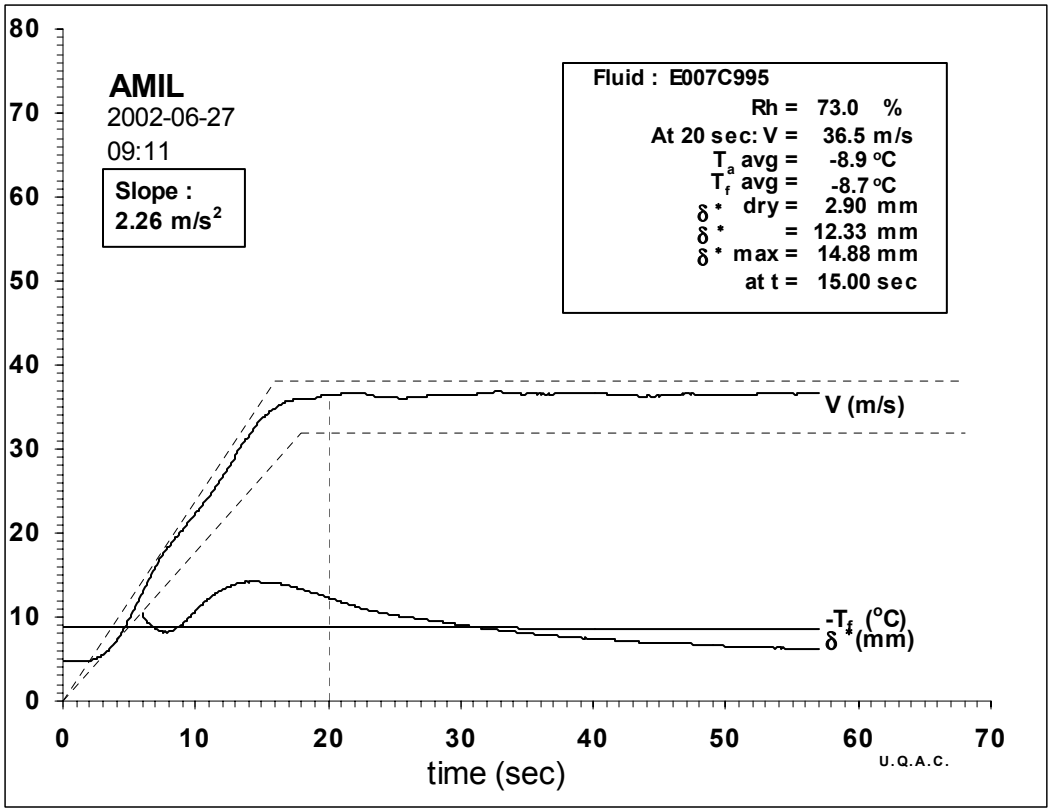
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.7	-9.3	64.8	3.33	35.3	0.72	12.79
20	-10.7	-9.3	64.8	3.28	35.1	0.68	12.43
21	-10.7	-9.3	64.9	3.27	35.0	0.64	12.02

Averages :

20	-10.7	**-9.3**	64.8	3.29	35.1	0.68	**12.40**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



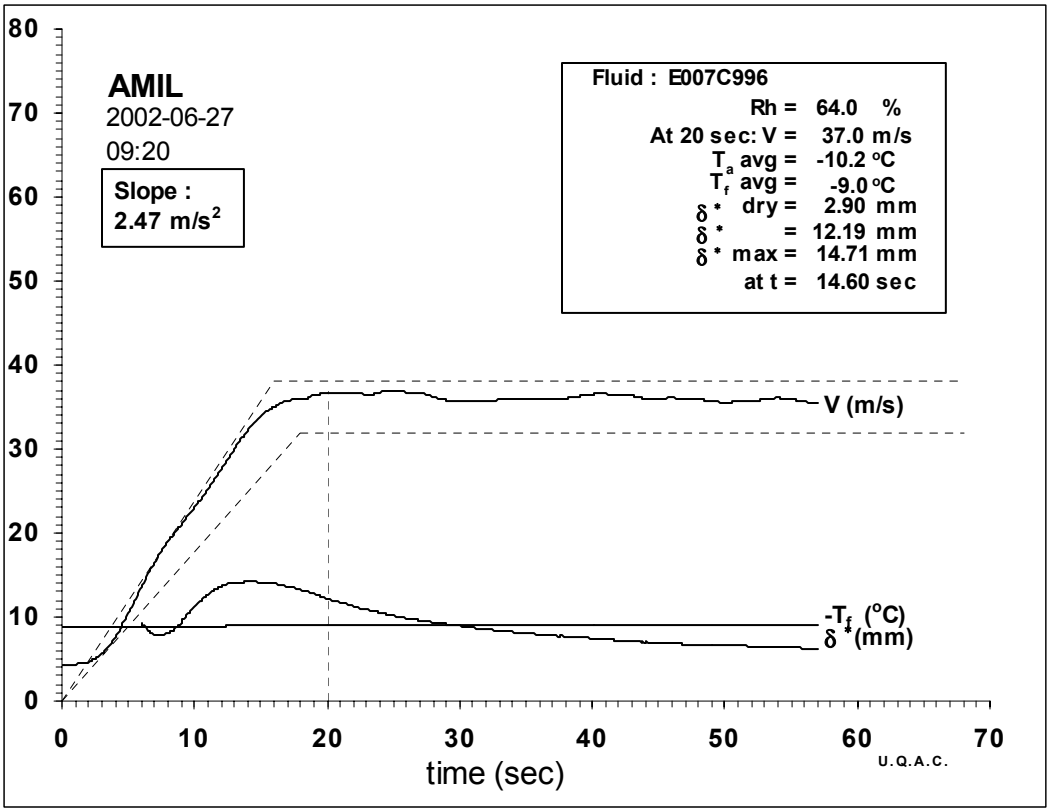
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-9.2	-8.8	70.0	3.44	36.0	0.74	12.78
20	-9.2	-8.8	75.0	3.48	36.2	0.71	12.38
21	-9.1	-8.8	72.0	3.67	37.2	0.71	11.87

Averages :

20	-9.2	**-8.8**	73.0	3.52	36.5	0.72	**12.33**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



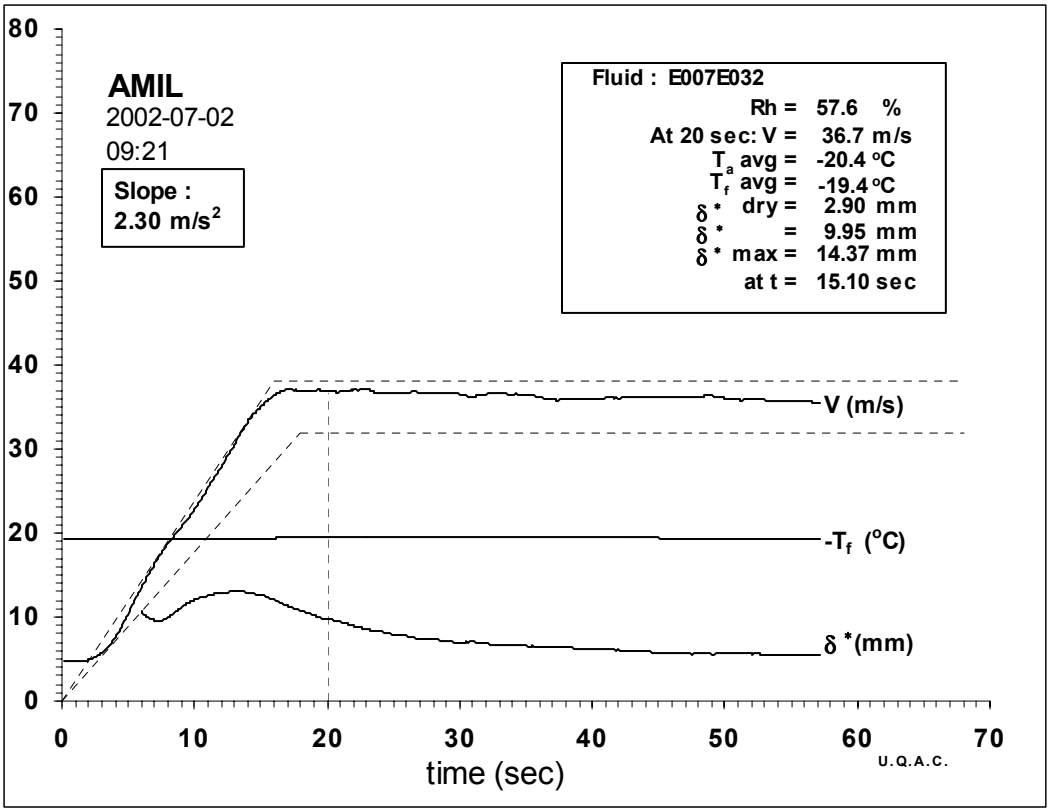
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.5	-9.0	64.9	3.55	36.5	0.74	12.45
20	-10.5	-9.0	65.4	3.51	36.3	0.72	12.33
21	-10.5	-9.0	60.7	3.94	38.4	0.74	11.73

Averages :

20	-10.5	**-9.0**	64.0	3.64	37.0	0.73	**12.19**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



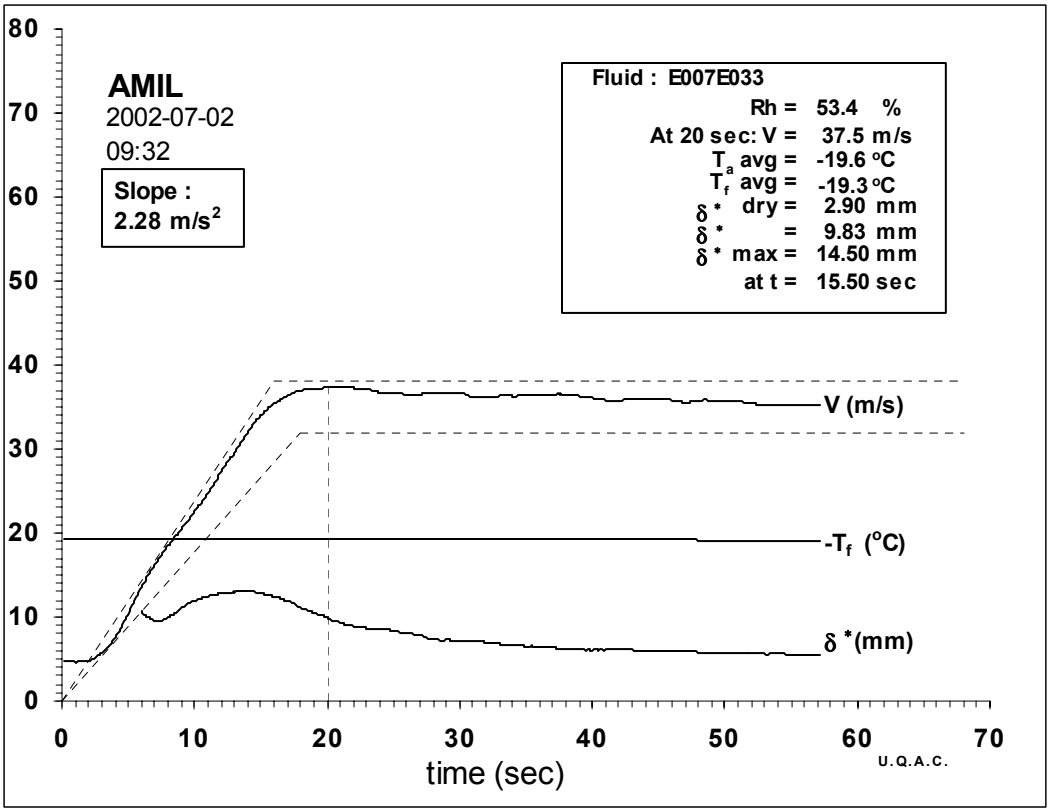
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-20.7	-19.4	56.6	3.63	36.2	0.58	10.59
20	-20.8	-19.4	58.4	3.76	36.8	0.52	9.73
21	-20.8	-19.5	56.9	3.75	36.8	0.52	9.77

Averages :

20	-20.8	**-19.4**	57.6	3.73	36.7	0.54	**9.95**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



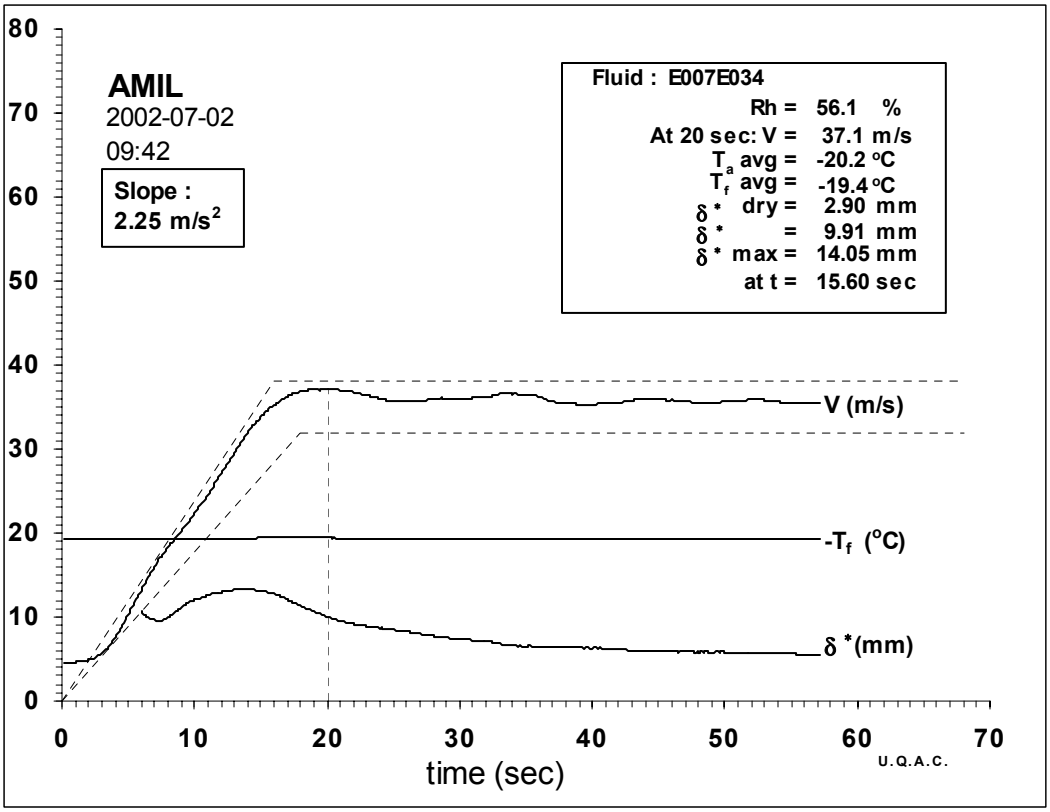
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-19.9	-19.4	51.8	3.86	37.4	0.63	10.76
20	-19.9	-19.3	53.6	4.03	38.2	0.53	9.46
21	-19.9	-19.3	54.6	3.67	36.4	0.50	9.69

Averages :

20	-19.9	**-19.3**	53.4	3.89	37.5	0.55	**9.83**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-20.6	-19.4	53.6	3.97	37.8	0.59	10.15
20	-20.6	-19.4	54.4	3.82	37.1	0.55	9.93
21	-20.6	-19.4	61.0	3.70	36.5	0.51	9.67

Averages :

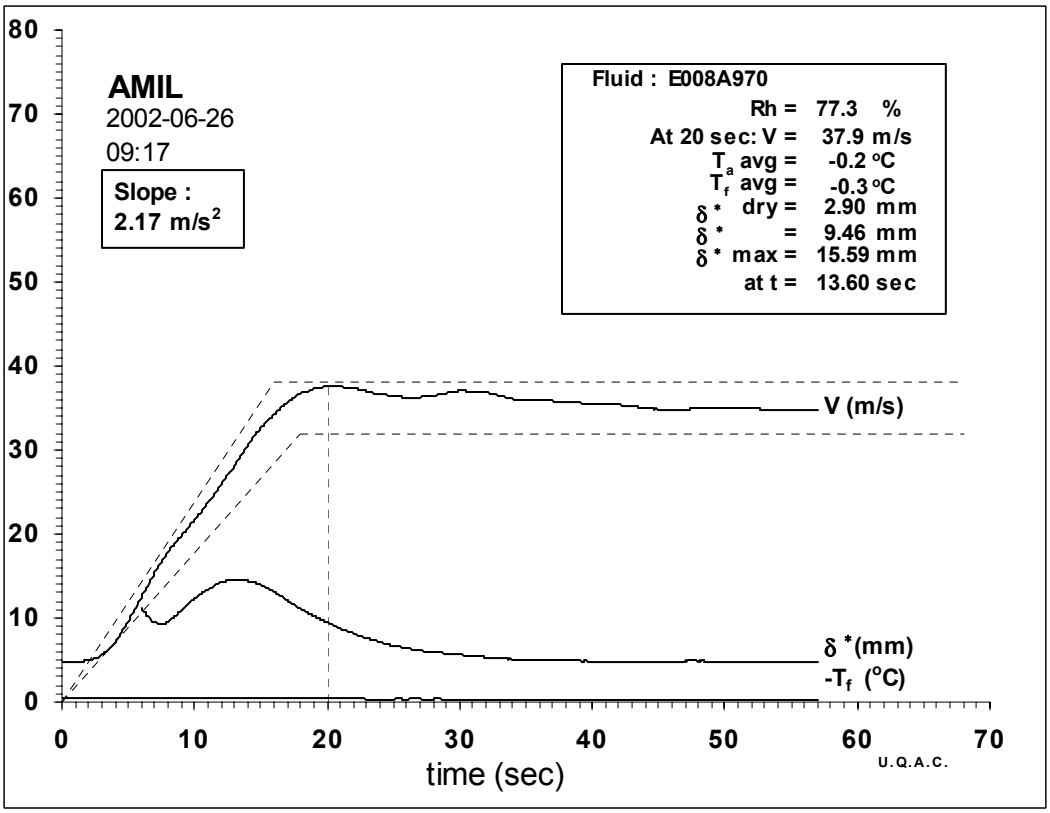
20	-20.6	**-19.4**	56.1	3.82	37.1	0.55	**9.91**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.15 SPCA AD-480, LOT M052, 75/25 DILUTION E-008.

FP-970



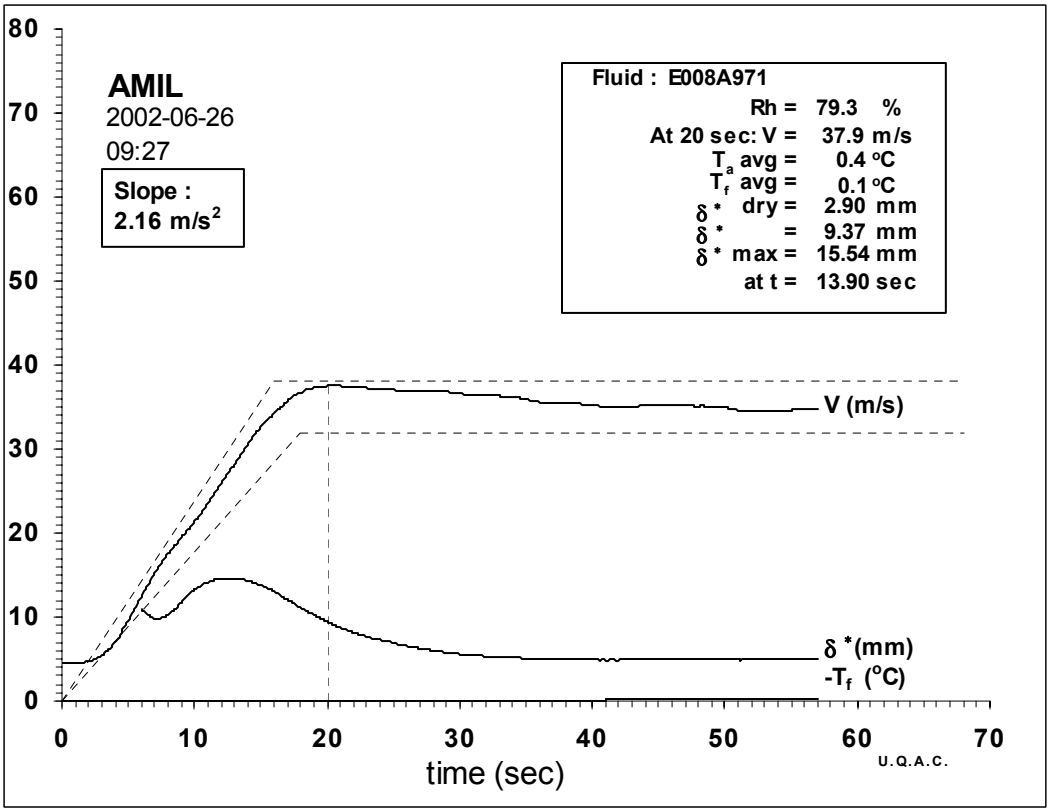
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.4	-0.4	77.1	3.72	38.1	0.56	10.24
20	-0.4	-0.4	77.0	3.69	37.9	0.49	9.42
21	-0.4	-0.4	77.8	3.67	37.8	0.44	8.88

Averages :

20	-0.4	**-0.4**	77.3	3.69	37.9	0.49	**9.46**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



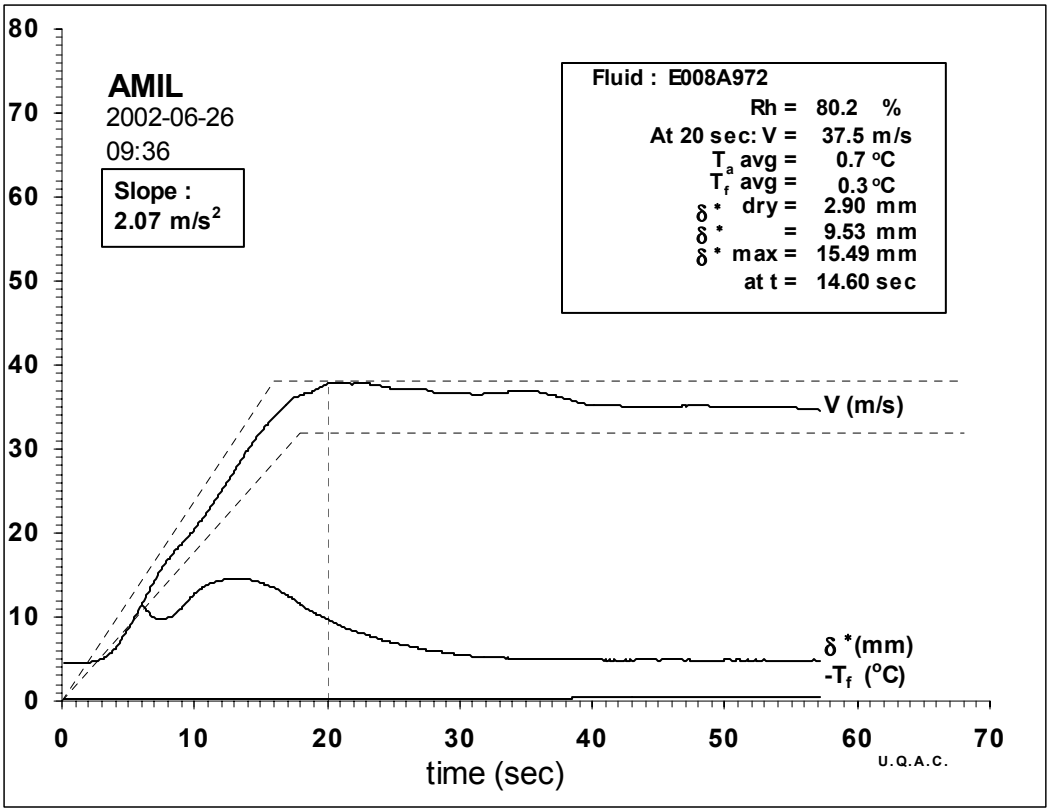
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.3	0.0	80.1	3.87	38.9	0.56	9.99
20	0.3	0.0	79.5	3.65	37.8	0.48	9.40
21	0.3	0.0	78.3	3.55	37.3	0.42	8.80

Averages :

20	0.3	**0.0**	79.3	3.68	37.9	0.48	**9.37**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



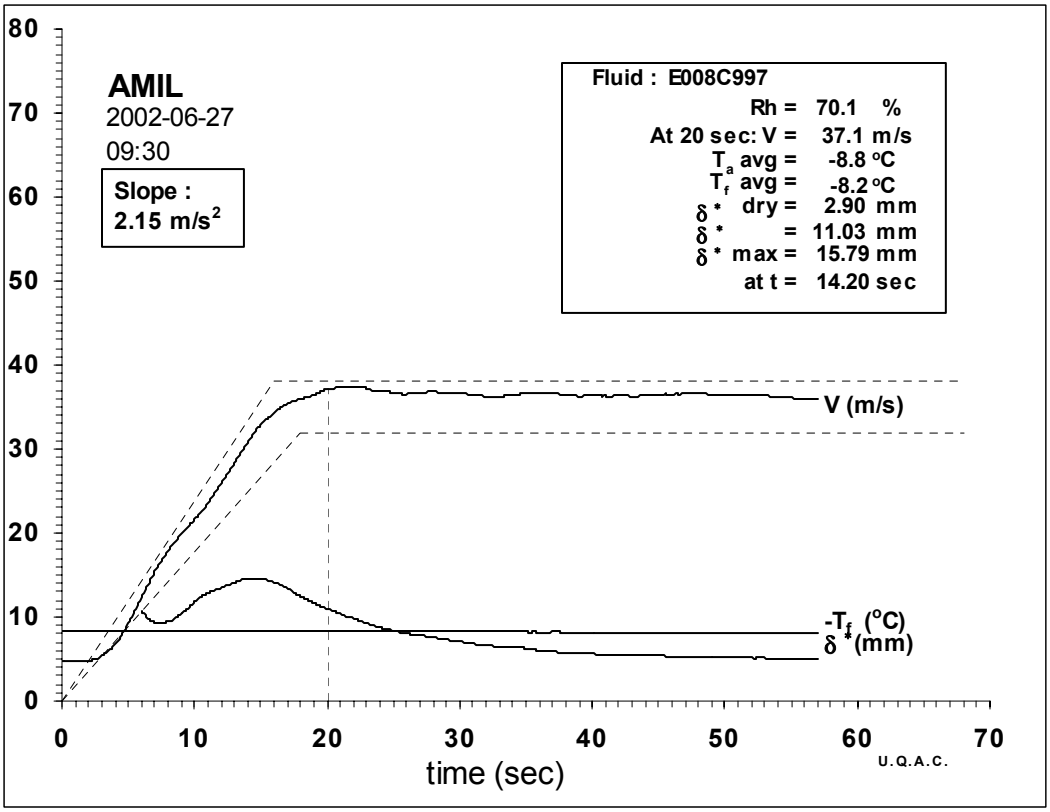
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	0.6	0.2	78.6	3.82	38.6	0.59	10.36
20	0.5	0.2	80.6	3.48	36.9	0.45	9.37
21	0.6	0.2	81.0	3.62	37.6	0.45	9.12

Averages :

20	0.6	**0.2**	80.2	3.60	37.5	0.48	**9.53**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



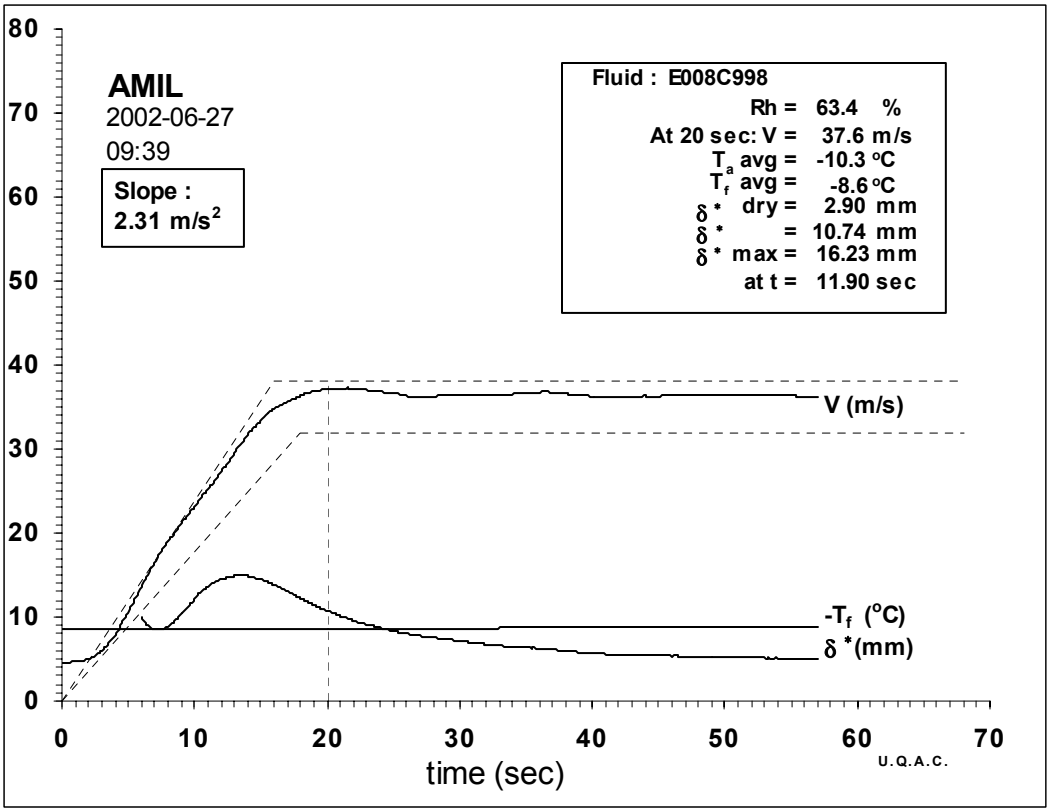
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-9.0	-8.3	69.9	3.55	36.6	0.65	11.52
20	-9.0	-8.3	71.5	3.59	36.8	0.61	10.96
21	-9.0	-8.3	68.1	3.83	38.0	0.63	10.74

Averages :

20	-9.0	**-8.3**	70.1	3.65	37.1	0.62	**11.03**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



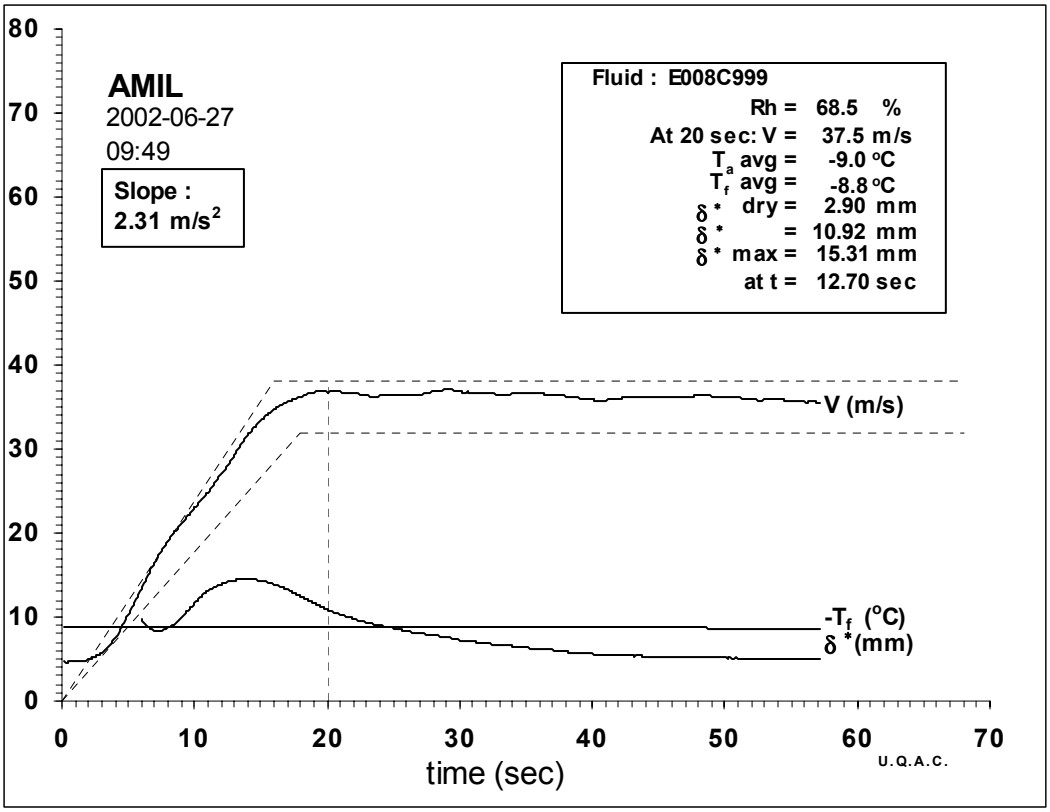
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.6	-8.5	65.5	3.64	37.0	0.64	11.29
20	-10.7	-8.6	62.4	3.83	37.9	0.63	10.74
21	-10.6	-8.6	63.4	3.75	37.5	0.57	10.28

Averages :

20	-10.7	**-8.6**	63.4	3.76	37.6	0.61	**10.74**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



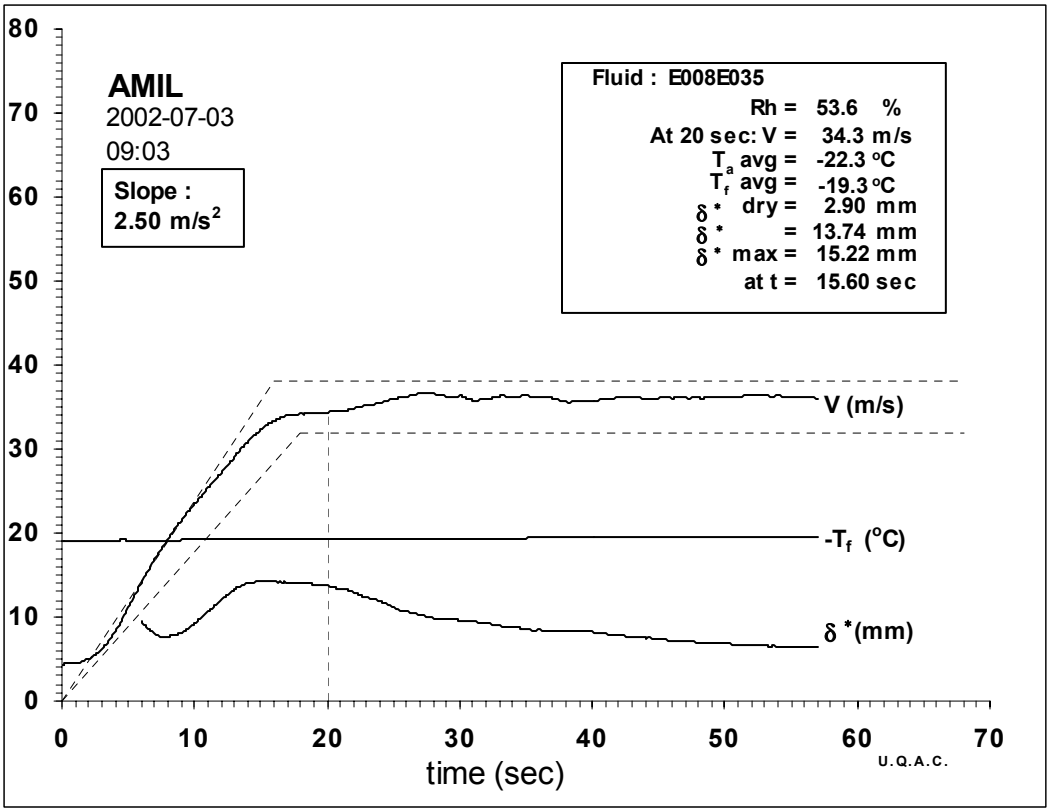
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-9.3	-8.9	66.8	3.71	37.4	0.67	11.37
20	-9.3	-8.9	68.6	3.76	37.6	0.64	11.01
21	-9.3	-8.9	69.9	3.72	37.4	0.58	10.39

Averages :

20	-9.3	**-8.9**	68.5	3.73	37.5	0.63	**10.92**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



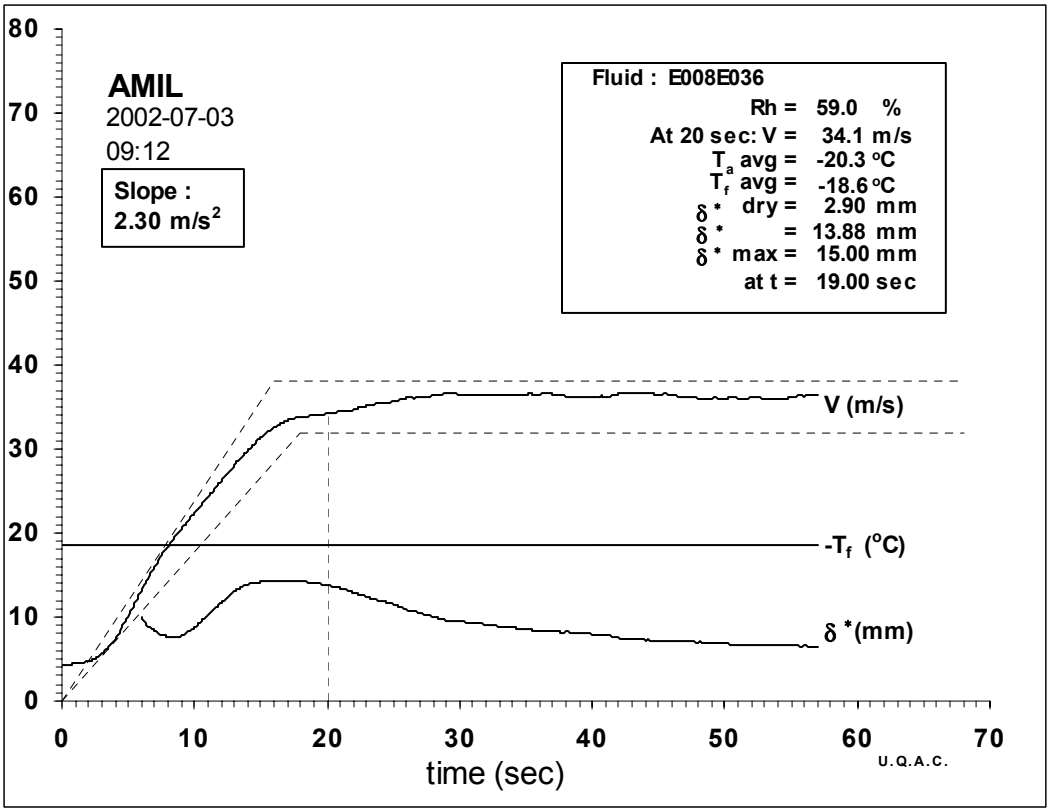
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-22.6	-19.3	51.9	3.30	34.4	0.79	13.67
20	-22.6	-19.3	55.3	3.27	34.2	0.80	13.85
21	-22.6	-19.3	52.2	3.30	34.4	0.79	13.60

Averages :

20	-22.6	**-19.3**	53.6	3.29	34.3	0.79	**13.74**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



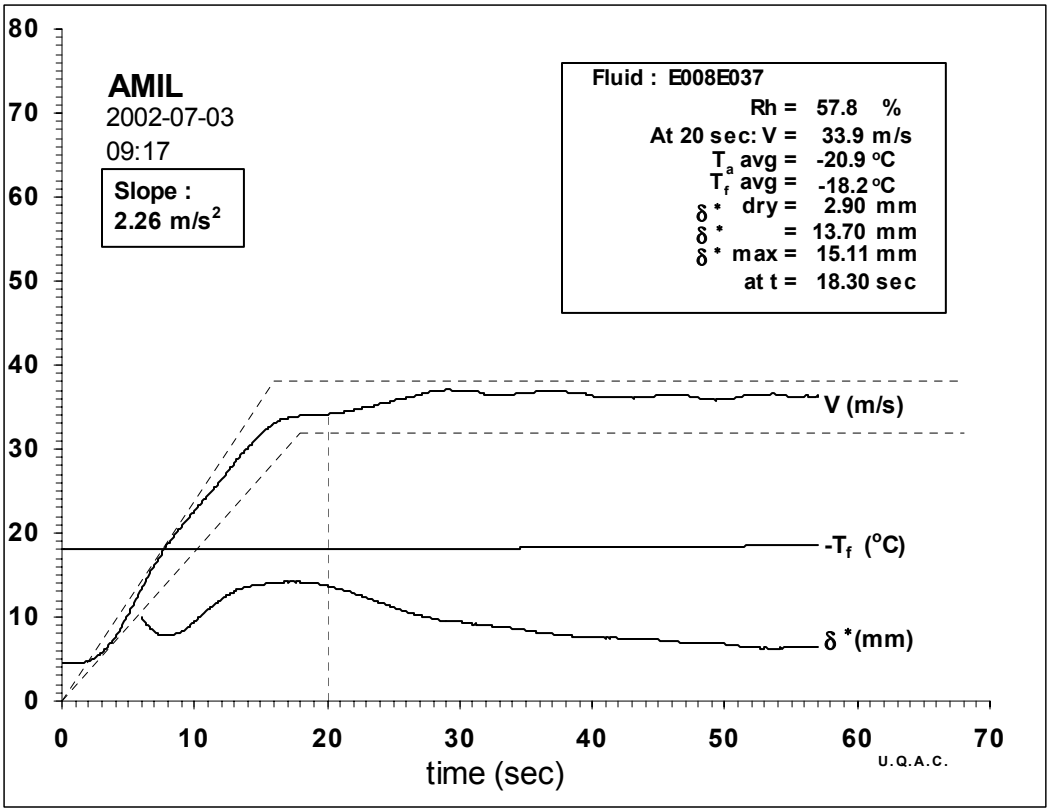
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-20.6	-18.6	63.2	3.25	34.3	0.85	14.41
20	-20.6	-18.6	58.3	3.18	33.9	0.79	13.96
21	-20.6	-18.6	56.7	3.28	34.4	0.75	13.30

Averages :

20	-20.6	**-18.6**	59.0	3.23	34.1	0.79	**13.88**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-18.1	56.7	3.15	33.7	0.78	13.91
20	-21.3	-18.1	56.6	3.18	33.8	0.76	13.64
21	-21.3	-18.1	60.8	3.28	34.3	0.78	13.63

Averages :

20	-21.3	**-18.1**	57.8	3.20	33.9	0.77	**13.70**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.16 SPCA AD-480, LOT M052, 50/50 DILUTION E-009.

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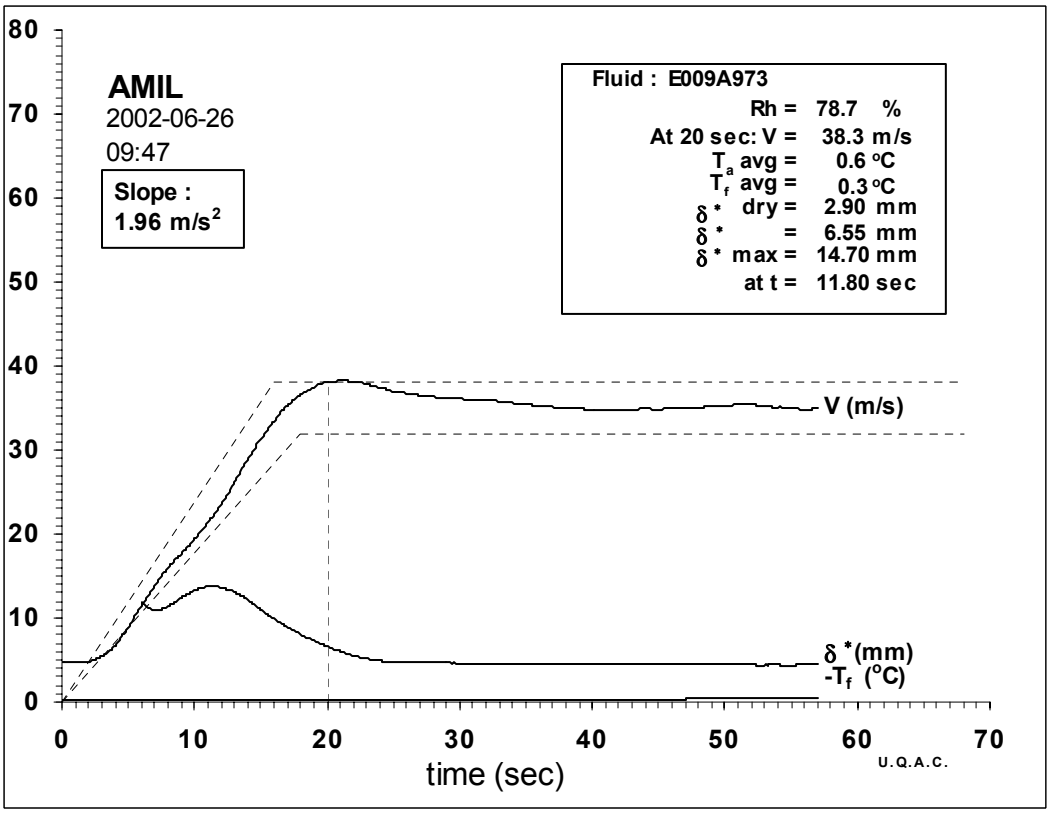


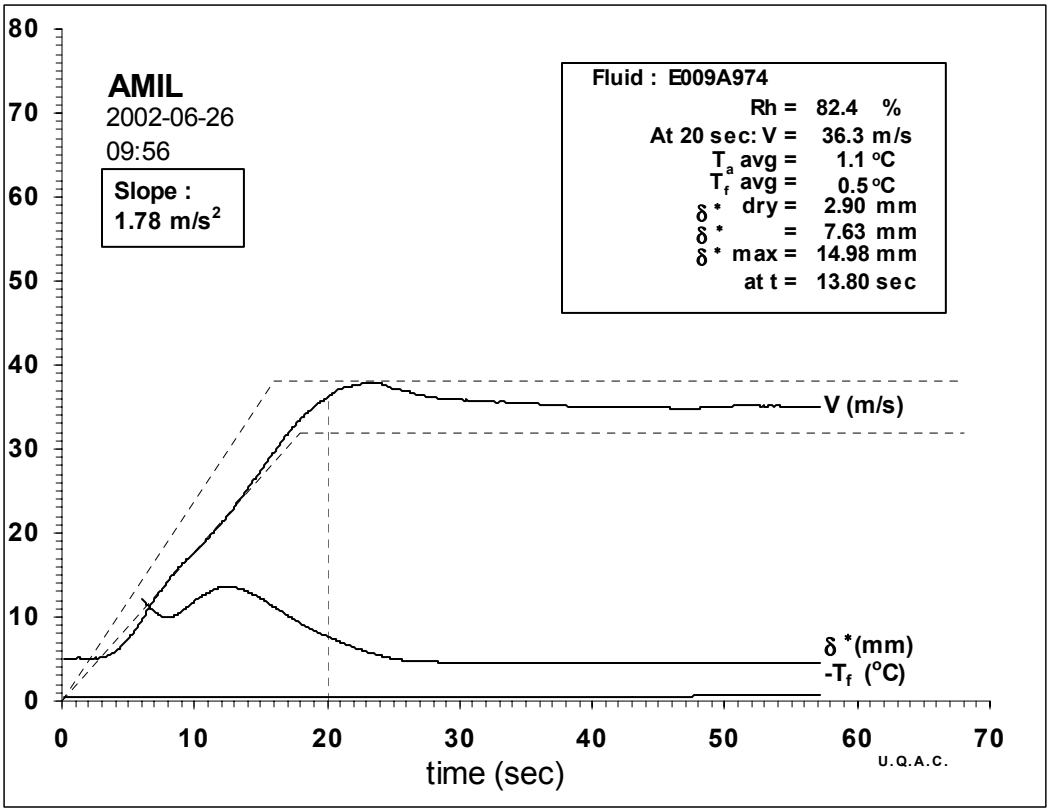
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.4	0.3	77.3	3.71	38.1	0.31	7.36
20	0.4	0.3	77.7	3.73	38.2	0.24	6.47
21	0.4	0.3	81.4	3.81	38.6	0.21	6.00

Averages :

20	0.4	**0.3**	78.7	3.75	38.3	0.25	**6.55**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



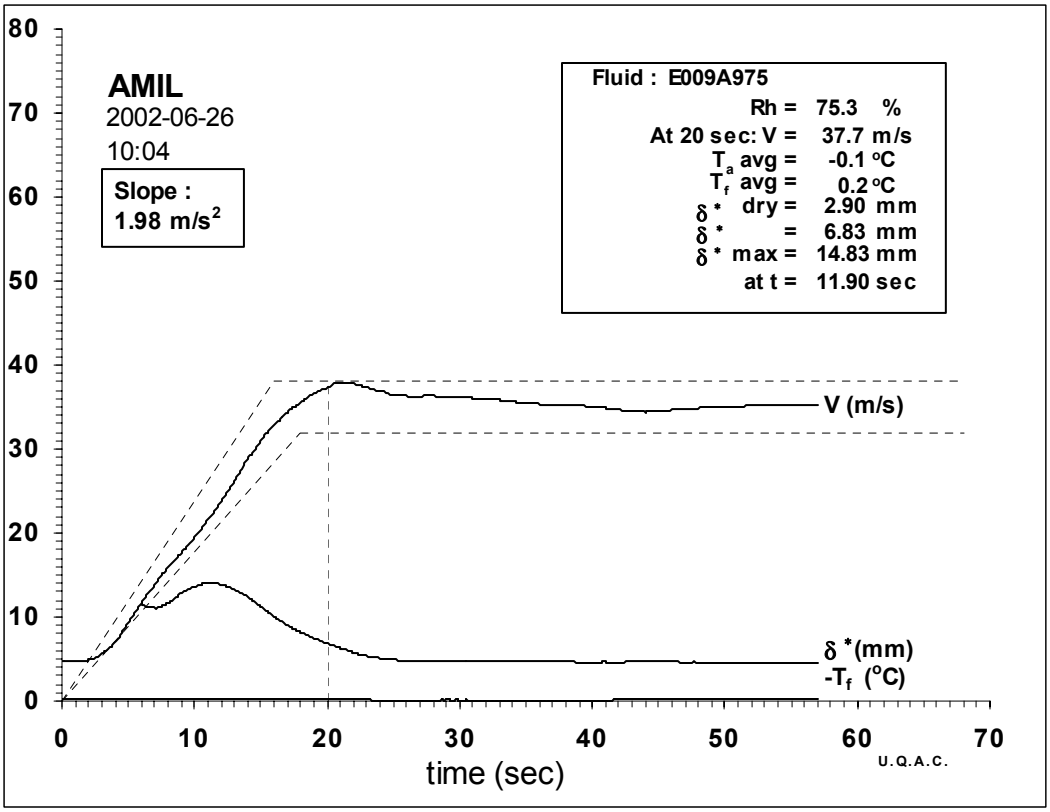
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	1.0	0.4	81.9	3.24	35.6	0.32	8.04
20	1.1	0.4	82.9	3.37	36.3	0.30	7.63
21	1.0	0.4	82.0	3.45	36.8	0.28	7.28

Averages :

20	1.0	**0.4**	82.4	3.36	36.3	0.30	**7.63**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



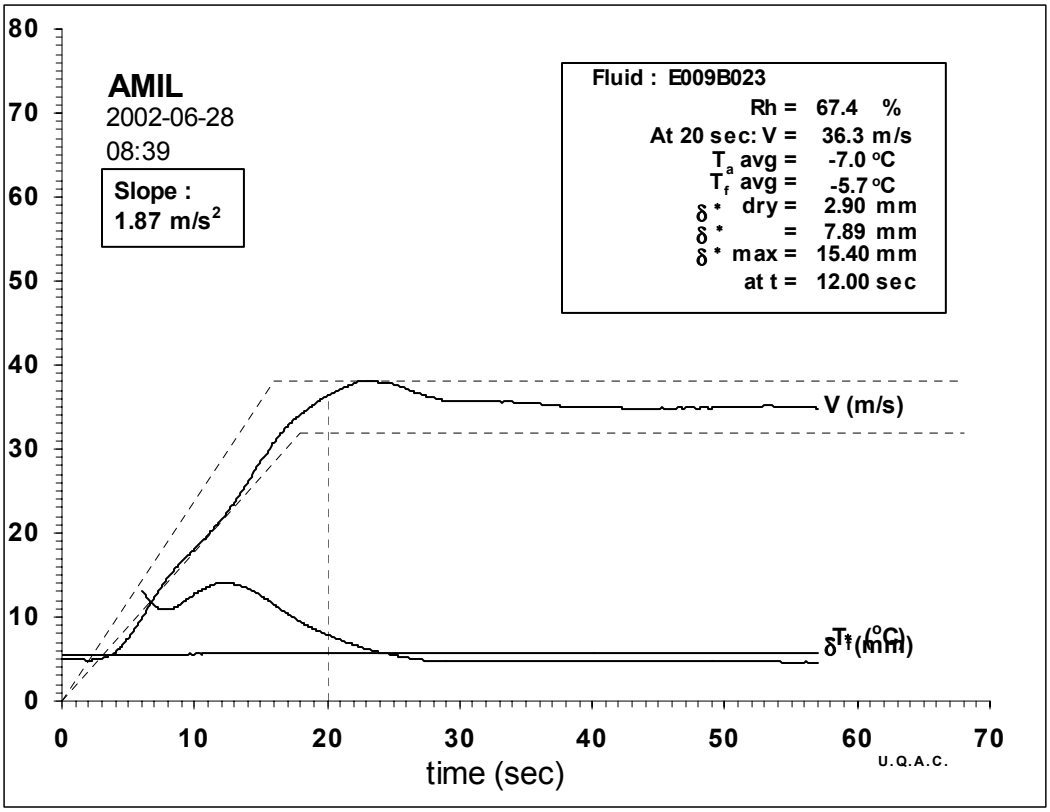
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.3	0.1	74.9	3.52	37.0	0.28	7.20
20	-0.3	0.1	75.2	3.67	37.8	0.27	6.93
21	-0.3	0.1	75.8	3.75	38.2	0.23	6.36

Averages :

20	-0.3	**0.1**	75.3	3.65	37.7	0.26	**6.83**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



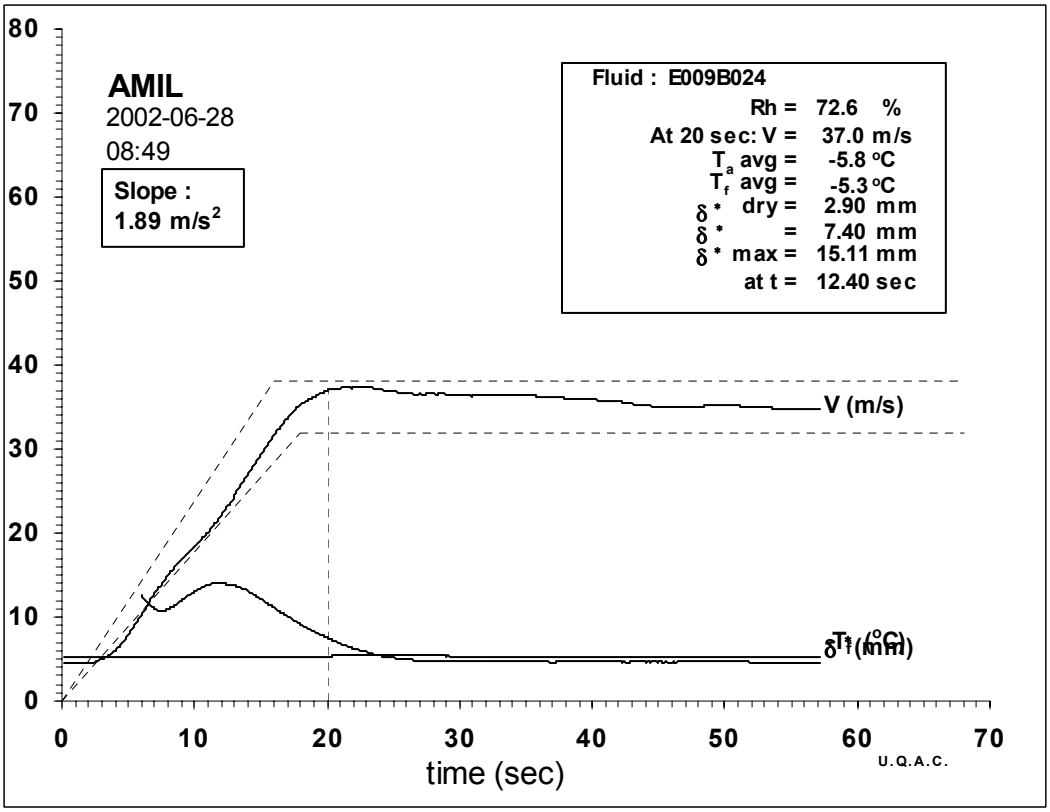
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-7.2	-5.7	70.3	3.31	35.4	0.37	8.65
20	-7.2	-5.7	66.6	3.43	36.1	0.34	7.97
21	-7.2	-5.7	66.5	3.70	37.5	0.29	7.11

Averages :

20	-7.2	**-5.7**	67.4	3.48	36.3	0.33	**7.89**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



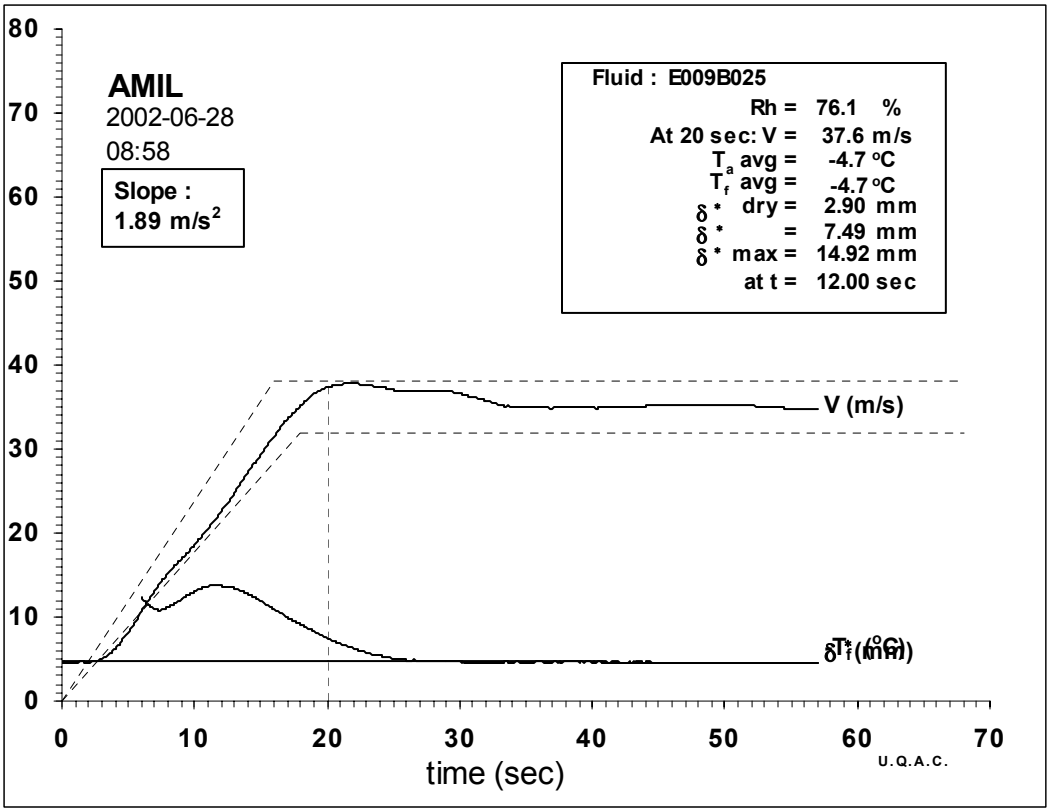
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-5.9	-5.3	69.0	3.64	37.3	0.38	8.32
20	-5.9	-5.4	72.2	3.61	37.1	0.30	7.28
21	-5.9	-5.4	76.2	3.52	36.7	0.25	6.83

Averages :

20	-5.9	**-5.4**	72.6	3.59	37.0	0.31	**7.40**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



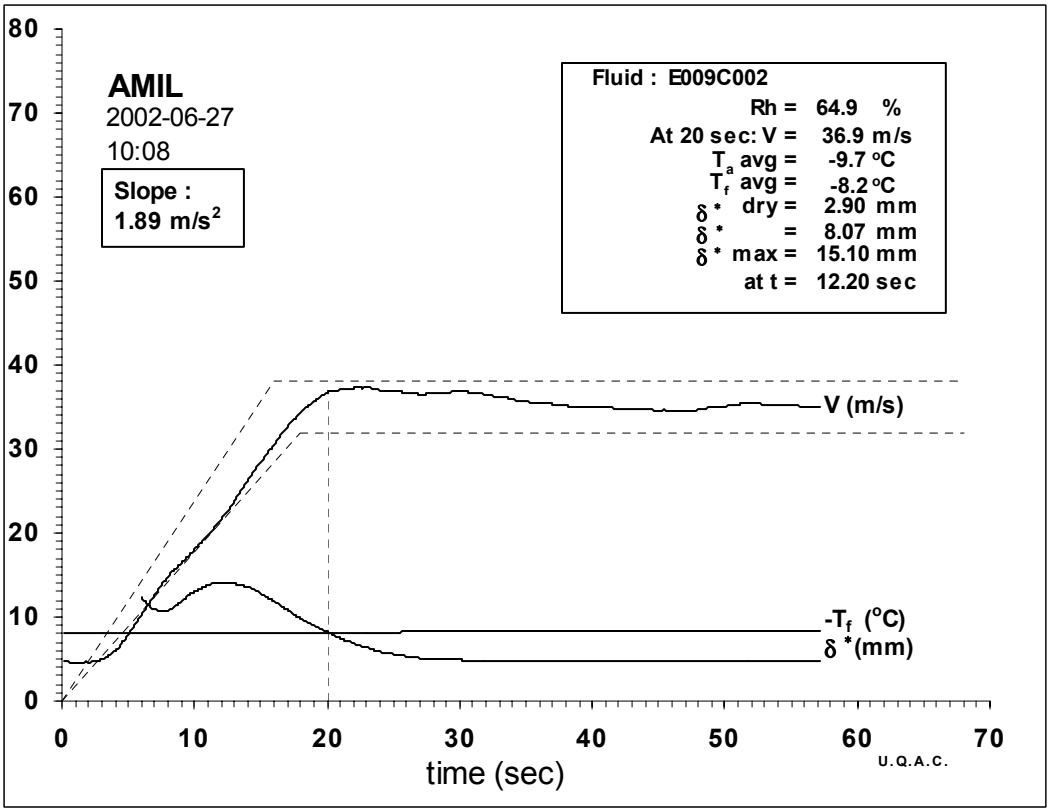
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-4.7	-4.8	76.1	3.41	36.2	0.32	7.85
20	-4.7	-4.8	75.9	3.71	37.7	0.34	7.67
21	-4.7	-4.8	76.3	3.85	38.4	0.29	6.90

Averages :

20	-4.7	**-4.8**	76.1	3.68	37.6	0.32	**7.49**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



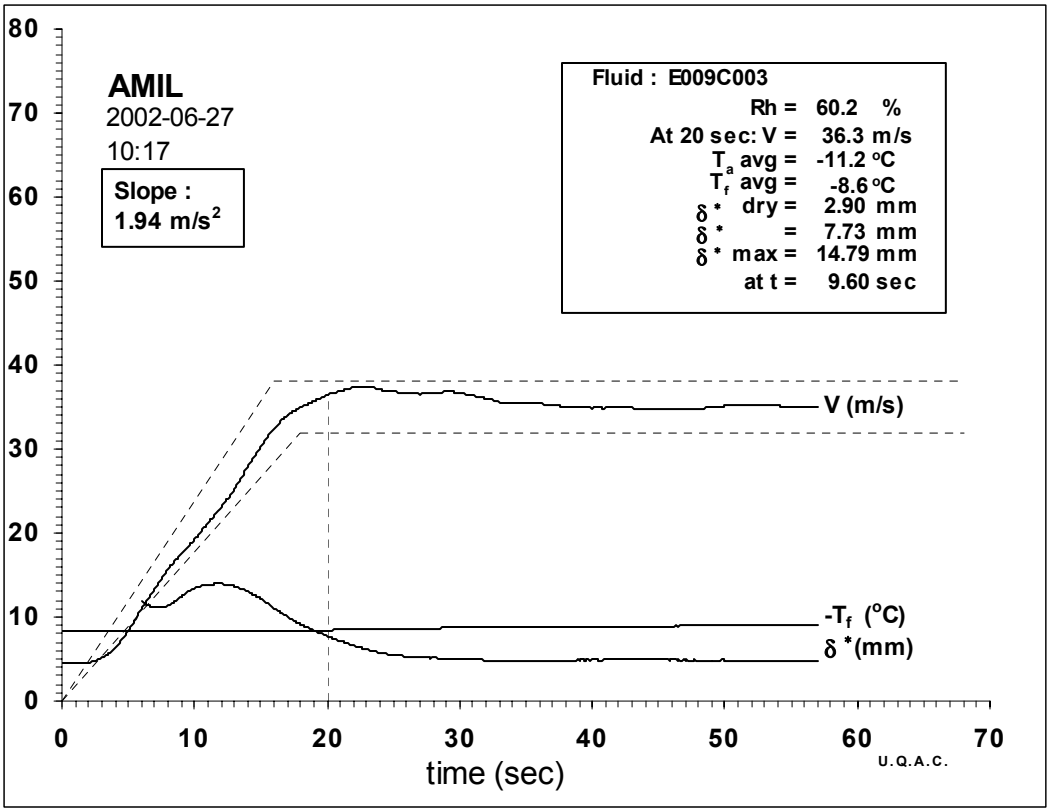
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.0	-8.1	65.3	3.61	36.8	0.40	8.54
20	-10.0	-8.1	63.4	3.62	36.9	0.37	8.18
21	-10.0	-8.1	67.0	3.63	37.0	0.32	7.48

Averages :

20	-10.0	**-8.1**	64.9	3.62	36.9	0.36	**8.07**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



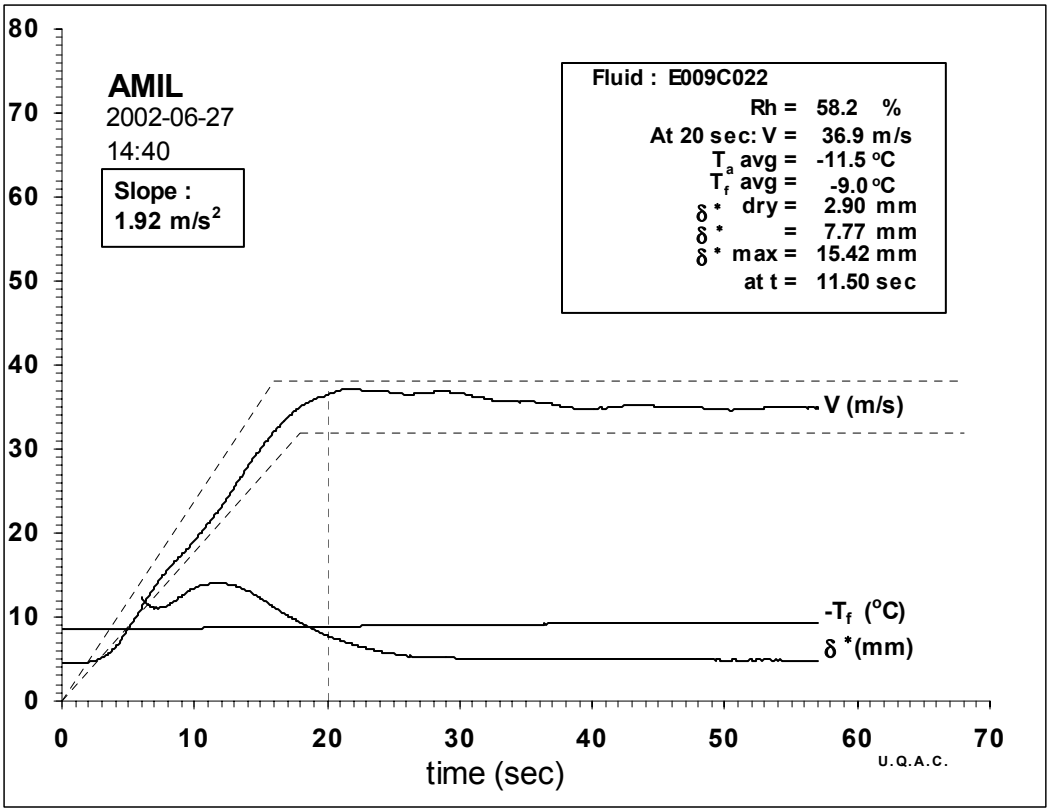
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-11.5	-8.4	60.6	3.31	35.2	0.32	7.92
20	-11.4	-8.4	60.2	3.53	36.4	0.34	7.88
21	-11.5	-8.5	59.9	3.68	37.1	0.31	7.33

Averages :

20	-11.5	**-8.4**	60.2	3.52	36.3	0.33	**7.73**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-11.9	-8.8	60.9	3.51	36.2	0.38	8.42
20	-11.9	-8.8	55.7	3.74	37.4	0.36	7.90
21	-11.9	-8.9	60.3	3.61	36.7	0.27	6.99

Averages :

20	-11.9	**-8.9**	58.2	3.65	36.9	0.34	**7.77**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.17 DOW ULTRA+, LOT 200103528-53, NEAT E-629.

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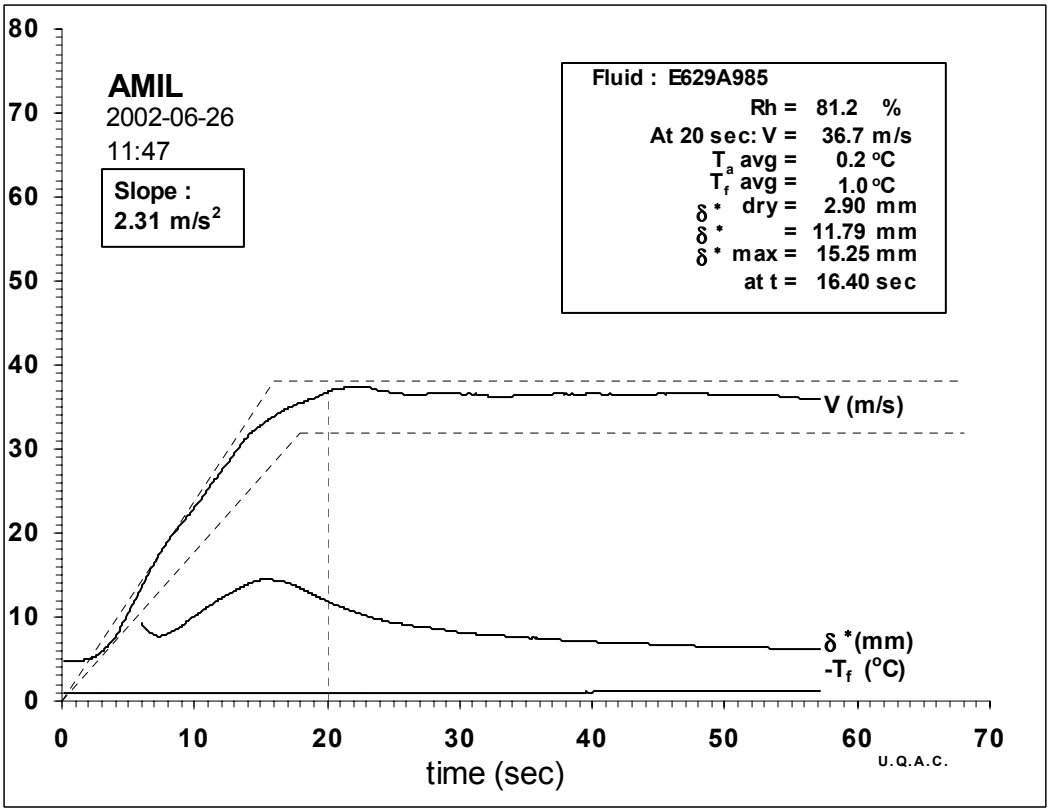


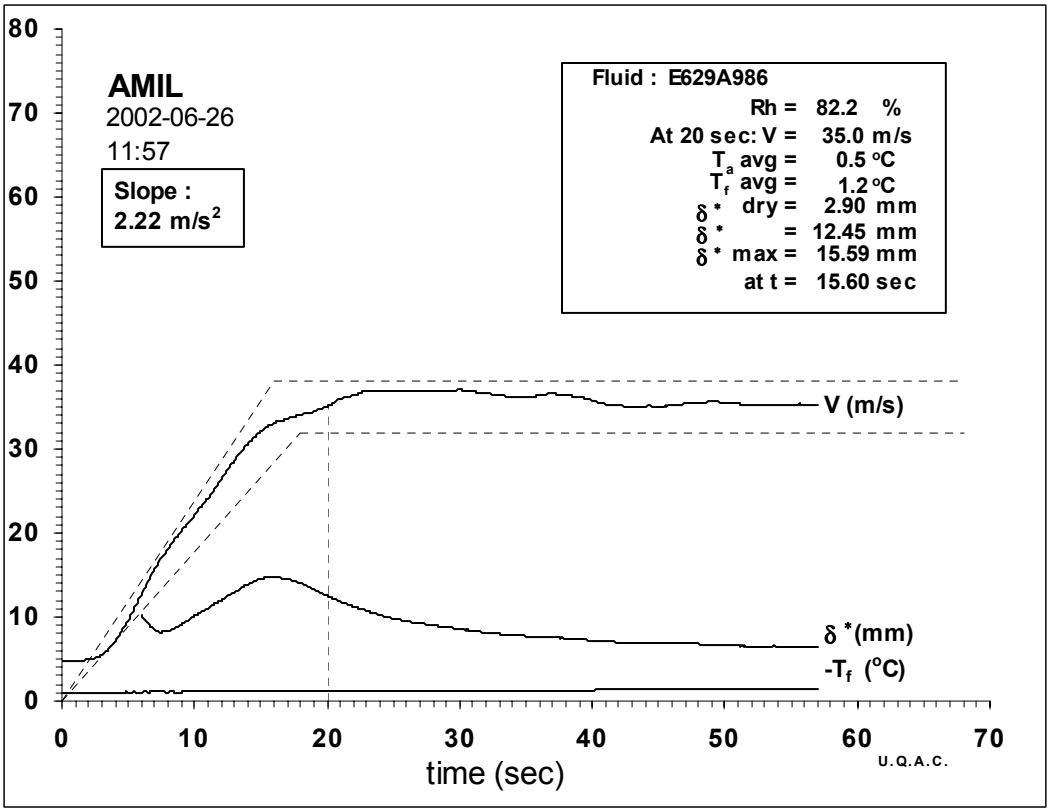
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.1	0.9	82.8	3.36	36.2	0.67	12.16
20	0.1	0.9	80.8	3.53	37.1	0.68	11.84
21	0.1	0.9	80.6	3.40	36.4	0.61	11.40

Averages :

20	0.1	**0.9**	81.2	3.45	36.7	0.66	**11.79**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



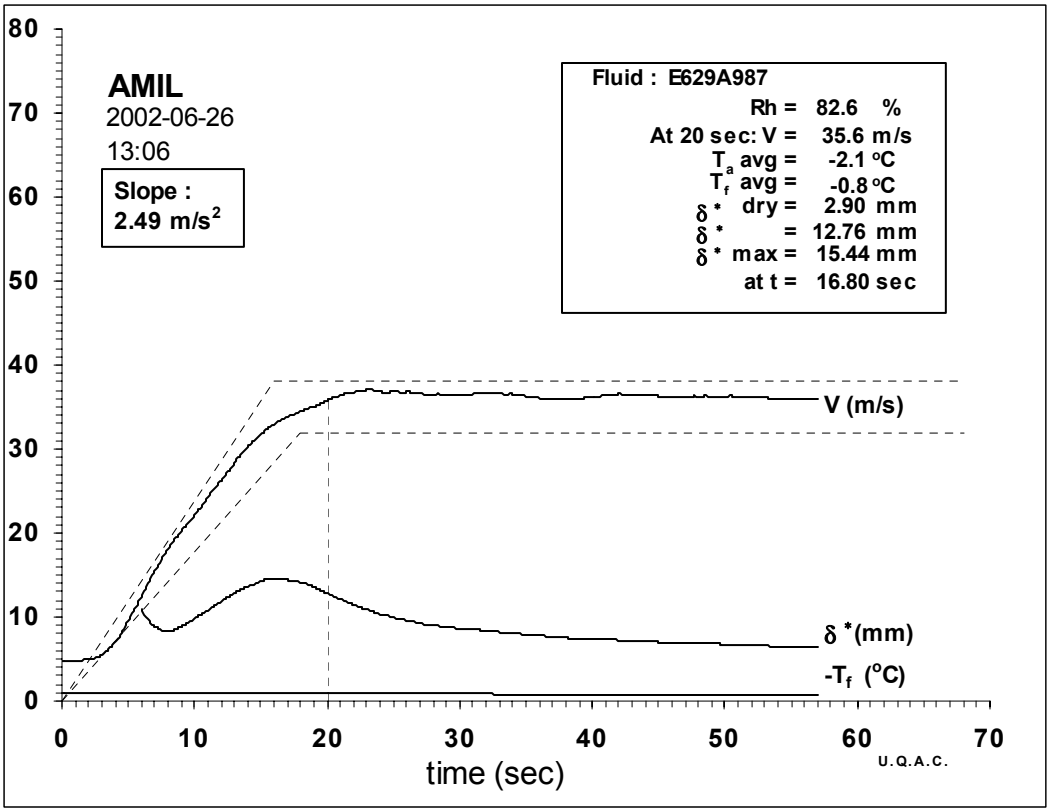
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.6	1.1	82.6	3.01	34.3	0.68	13.15
20	0.5	1.1	81.8	3.16	35.1	0.65	12.36
21	0.5	1.1	82.5	3.20	35.4	0.63	12.03

Averages :

20	0.5	**1.1**	82.2	3.14	35.0	0.65	**12.45**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



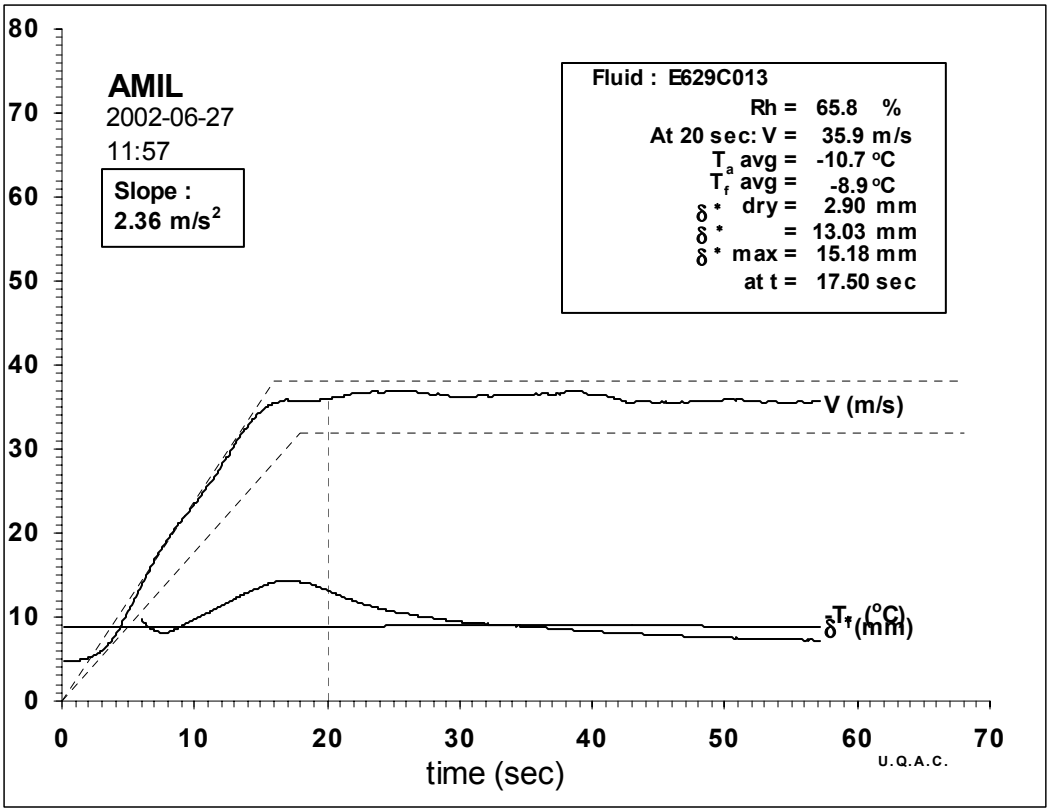
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-2.2	-0.9	85.5	3.19	35.1	0.72	13.18
20	-2.2	-0.9	82.0	3.25	35.5	0.71	12.83
21	-2.2	-0.9	81.0	3.39	36.2	0.69	12.30

Averages :

20	-2.2	**-0.9**	82.6	3.27	35.6	0.70	**12.76**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



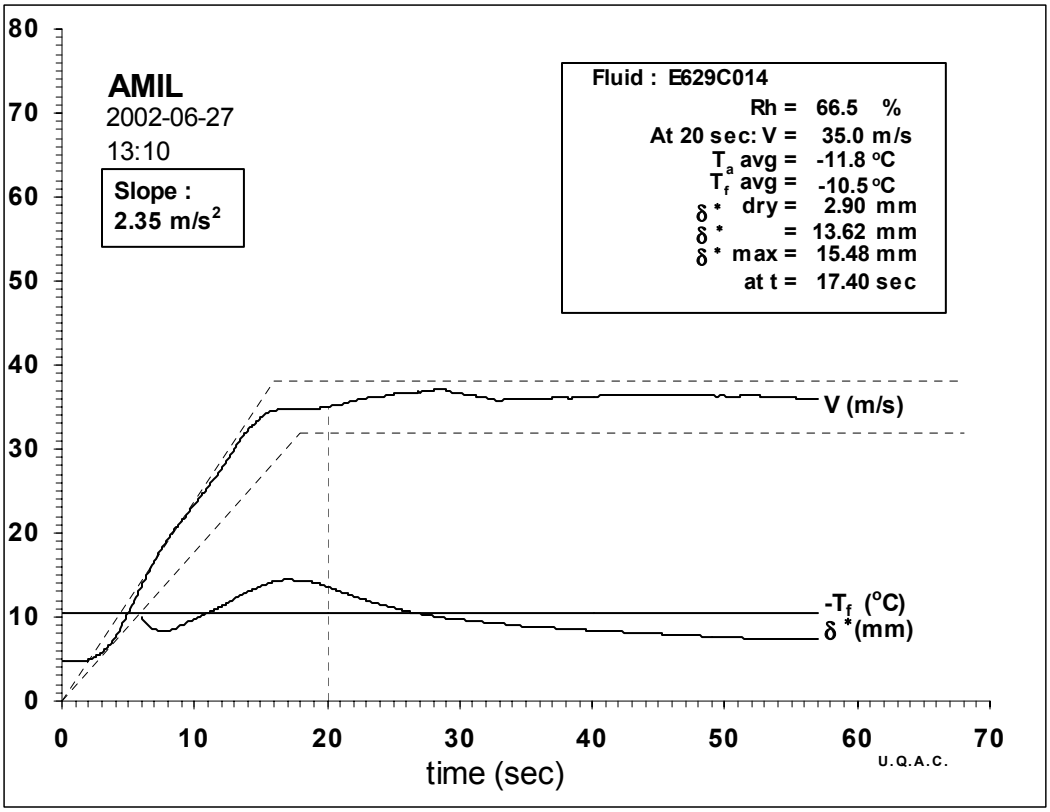
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-11.0	-8.9	66.1	3.27	35.0	0.79	13.67
20	-11.0	-8.9	66.7	3.45	35.9	0.78	13.12
21	-11.0	-8.9	63.9	3.57	36.6	0.73	12.35

Averages :

20	-11.0	**-8.9**	65.8	3.44	35.9	0.77	**13.03**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



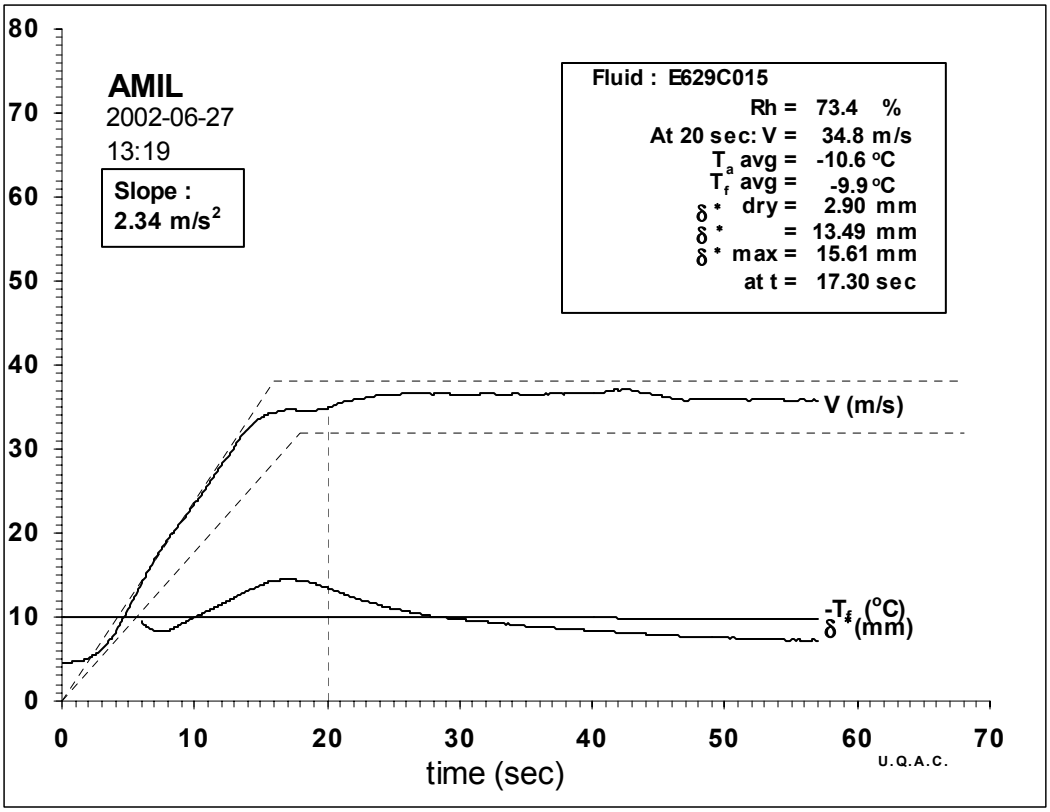
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-12.1	-10.6	67.5	3.23	34.7	0.82	14.14
20	-12.1	-10.6	65.0	3.29	35.0	0.78	13.57
21	-12.0	-10.6	68.2	3.33	35.3	0.76	13.25

Averages :

20	-12.1	**-10.6**	66.5	3.29	35.0	0.78	**13.62**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



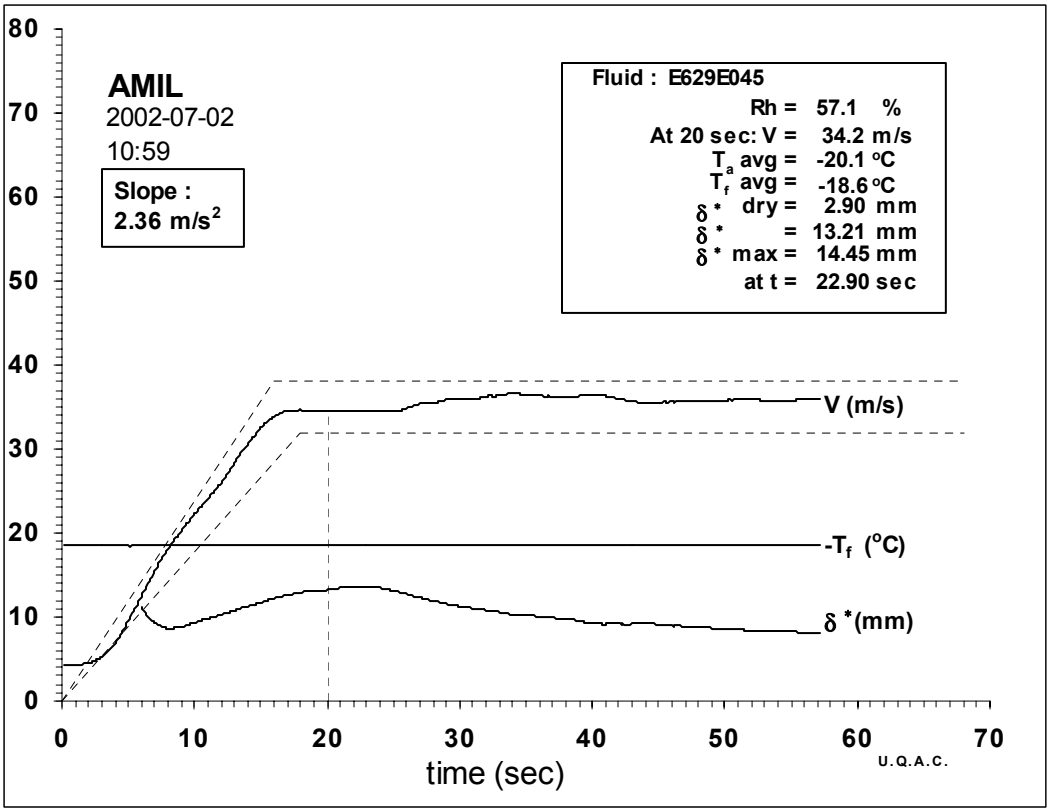
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.8	-10.1	71.4	3.18	34.5	0.80	14.09
20	-10.8	-10.1	74.9	3.24	34.9	0.77	13.54
21	-10.8	-10.0	72.6	3.26	34.9	0.71	12.91

Averages :

20	-10.8	**-10.0**	73.4	3.23	34.8	0.76	**13.49**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



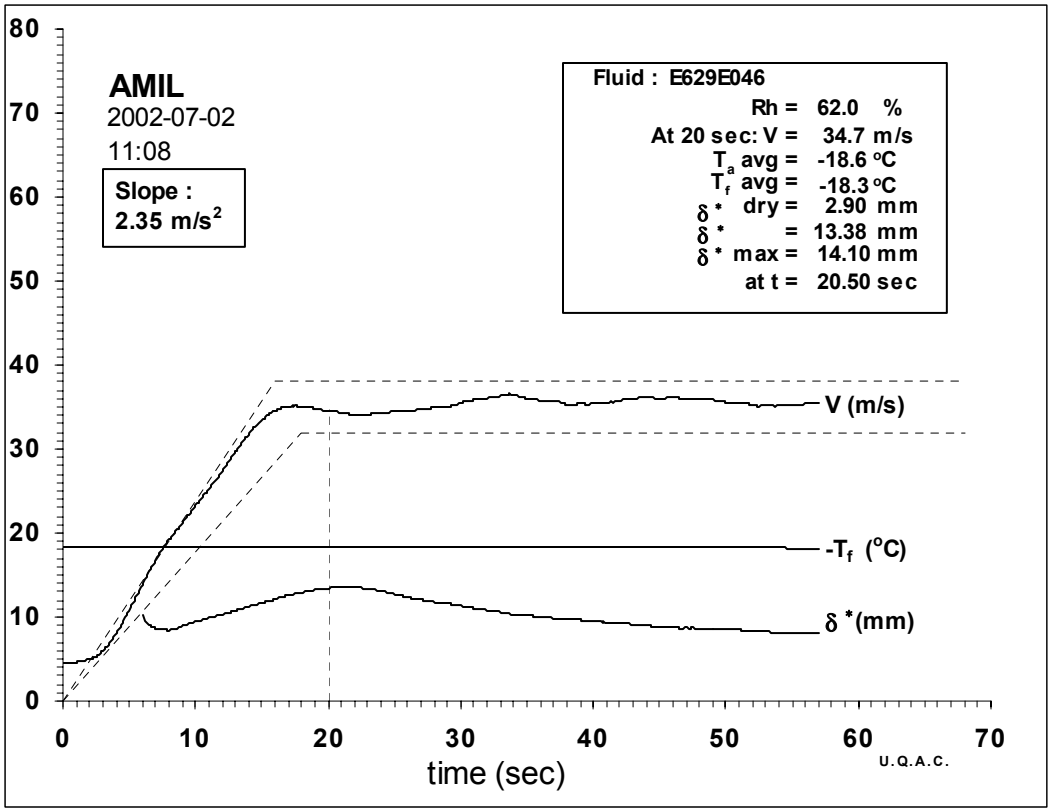
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-20.5	-18.5	56.2	3.32	34.6	0.75	13.12
20	-20.5	-18.5	56.3	3.20	34.0	0.73	13.27
21	-20.5	-18.5	59.2	3.26	34.3	0.74	13.20

Averages :

20	-20.5	**-18.5**	57.1	3.25	34.2	0.74	**13.21**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



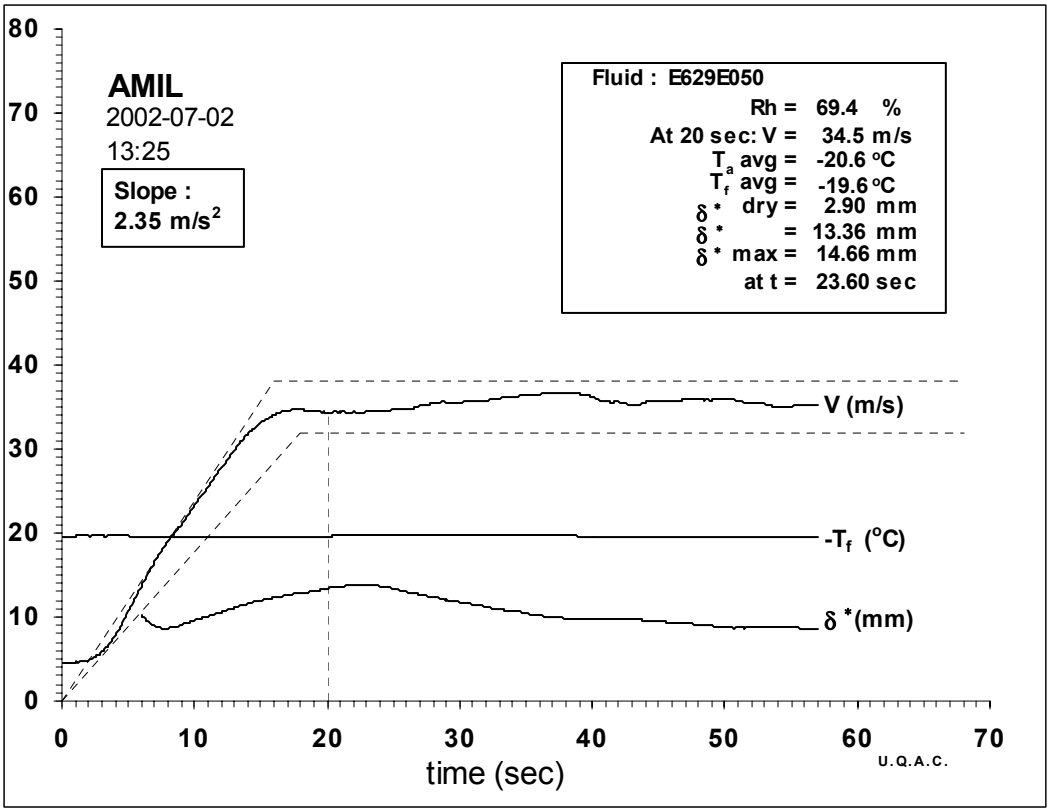
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-18.9	-18.4	66.1	3.40	35.2	0.75	12.95
20	-18.9	-18.4	59.6	3.28	34.5	0.77	13.47
21	-18.9	-18.4	62.5	3.27	34.5	0.78	13.60

Averages :

20	-18.9	**-18.4**	62.0	3.31	34.7	0.77	**13.38**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-20.9	-19.6	67.6	3.43	35.2	0.79	13.37
20	-20.8	-19.6	72.4	3.26	34.3	0.73	13.06
21	-20.8	-19.6	65.7	3.24	34.2	0.79	13.84

Averages :

20	-20.9	**-19.6**	69.4	3.29	34.5	0.76	**13.36**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.18 DOW ULTRA+, LOT 200103528-53, 75/25 DILUTION E-630.

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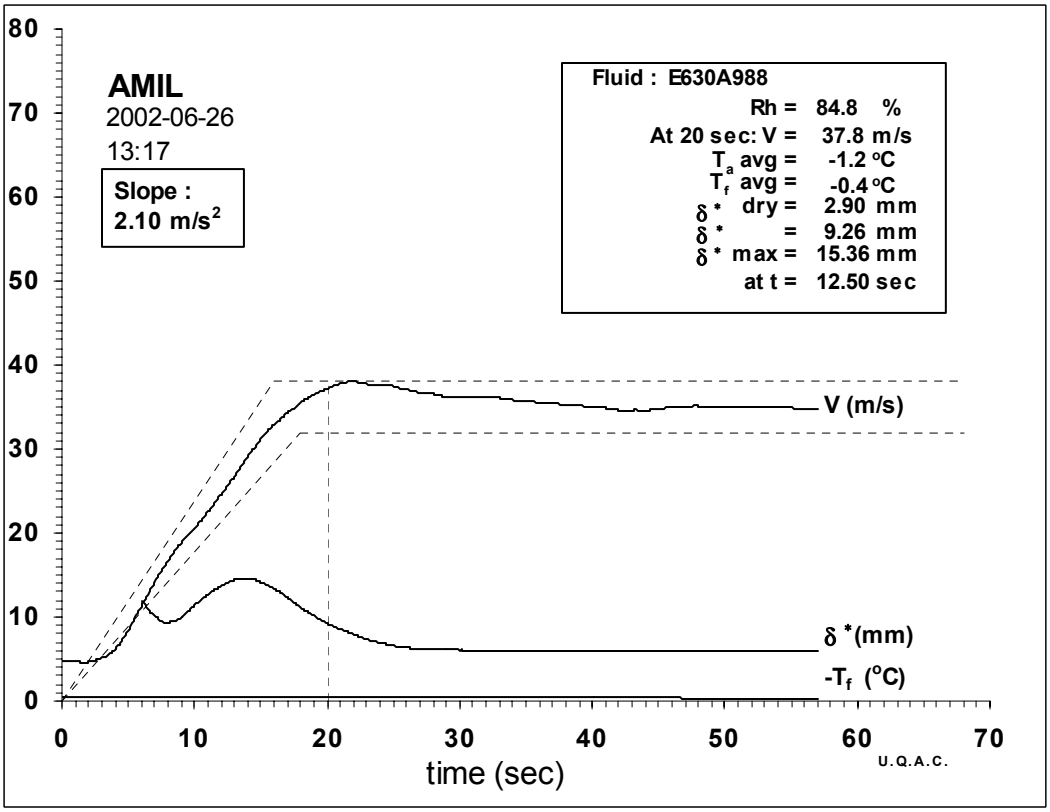


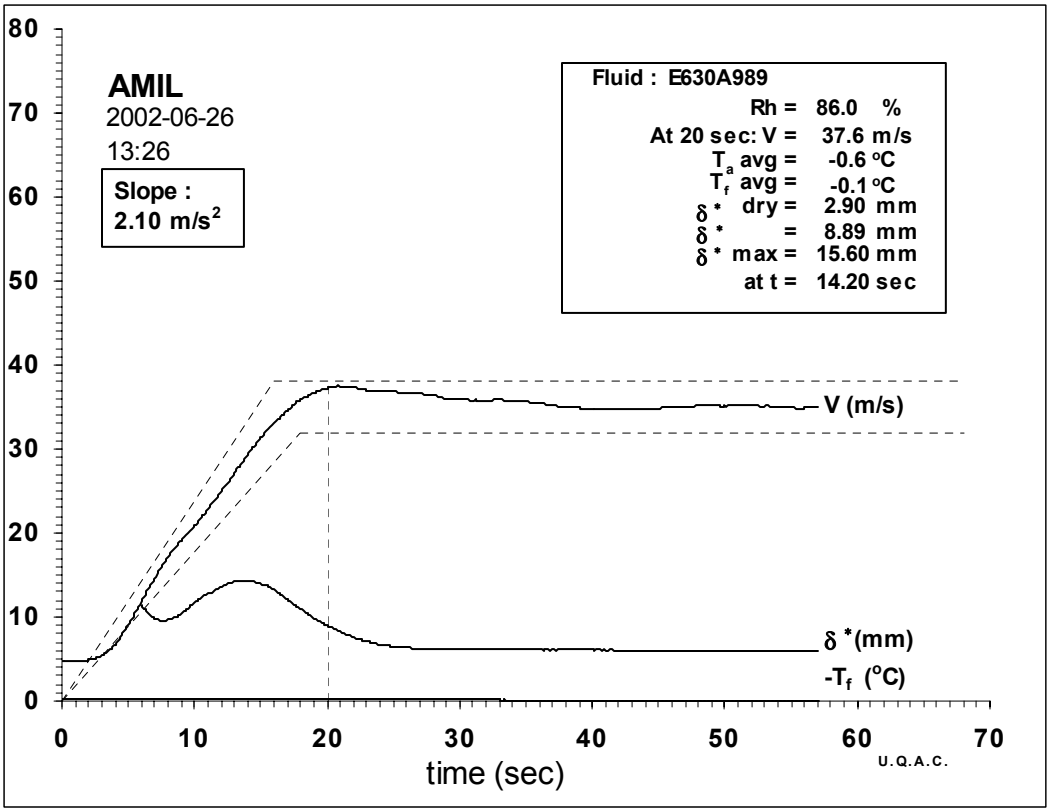
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-1.3	-0.5	86.2	3.39	36.3	0.45	9.46
20	-1.3	-0.5	85.1	3.71	38.0	0.49	9.41
21	-1.3	-0.5	83.3	3.86	38.7	0.46	8.85

Averages :

20	-1.3	**-0.5**	84.8	3.68	37.8	0.47	**9.26**

Test Duct Dimensions :

S_2 = 30570.314 mm² S_3 = 33094.834 mm² B_3 = 301.82 mm C_3 = 822.97 mm



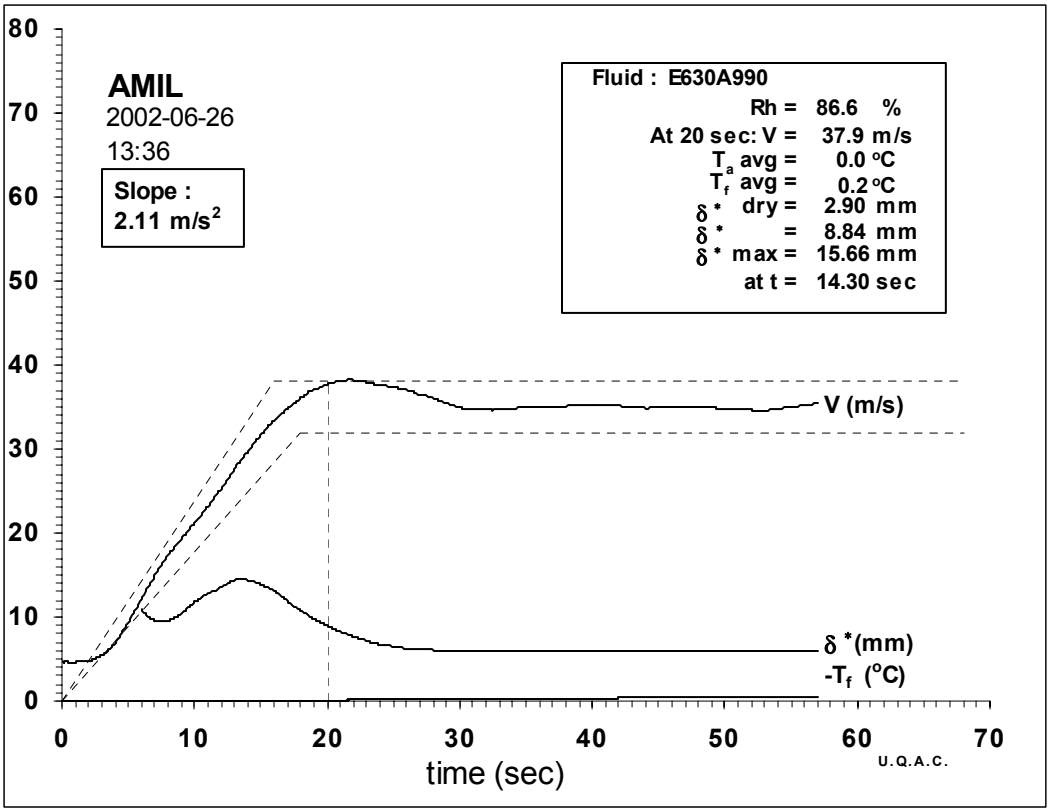
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.6	-0.2	88.6	3.66	37.8	0.52	9.86
20	-0.6	-0.2	85.2	3.56	37.2	0.41	8.76
21	-0.7	-0.2	85.4	3.74	38.1	0.40	8.32

Averages :

20	-0.6	**-0.2**	86.0	3.63	37.6	0.43	**8.89**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



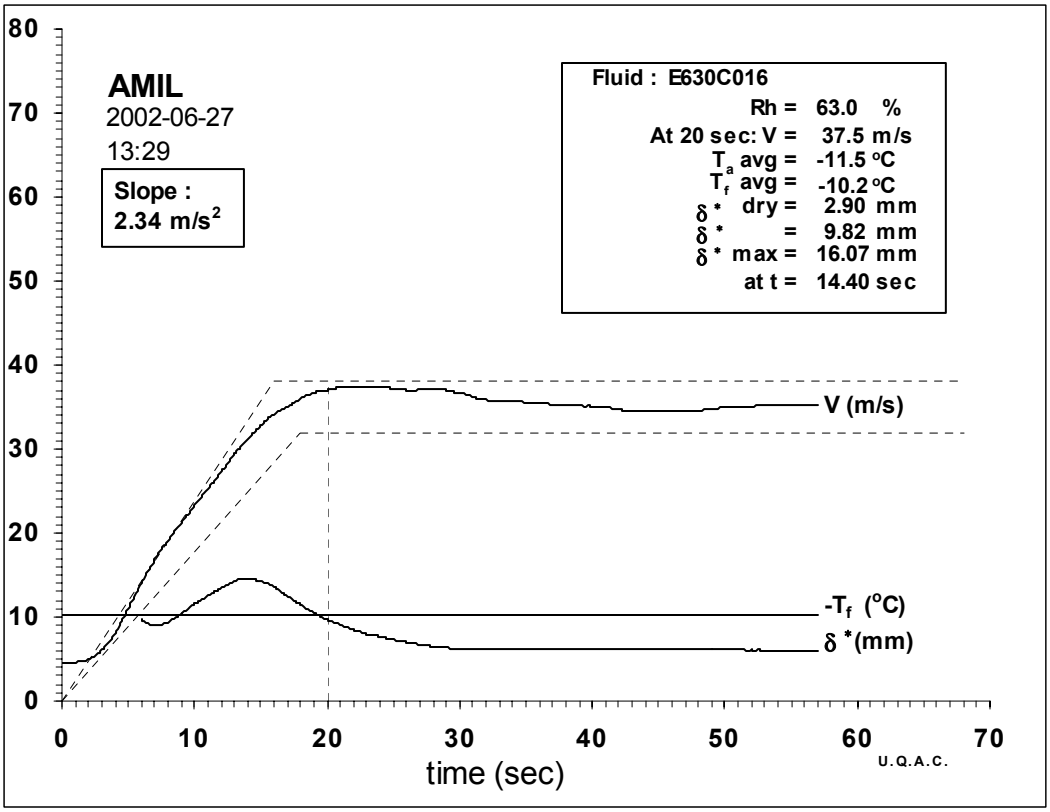
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-0.1	0.1	86.4	3.54	37.2	0.45	9.25
20	0.0	0.1	86.8	3.72	38.1	0.45	9.00
21	0.0	0.1	86.3	3.74	38.2	0.39	8.23

Averages :

20	0.0	**0.1**	86.6	3.68	37.9	0.43	**8.84**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



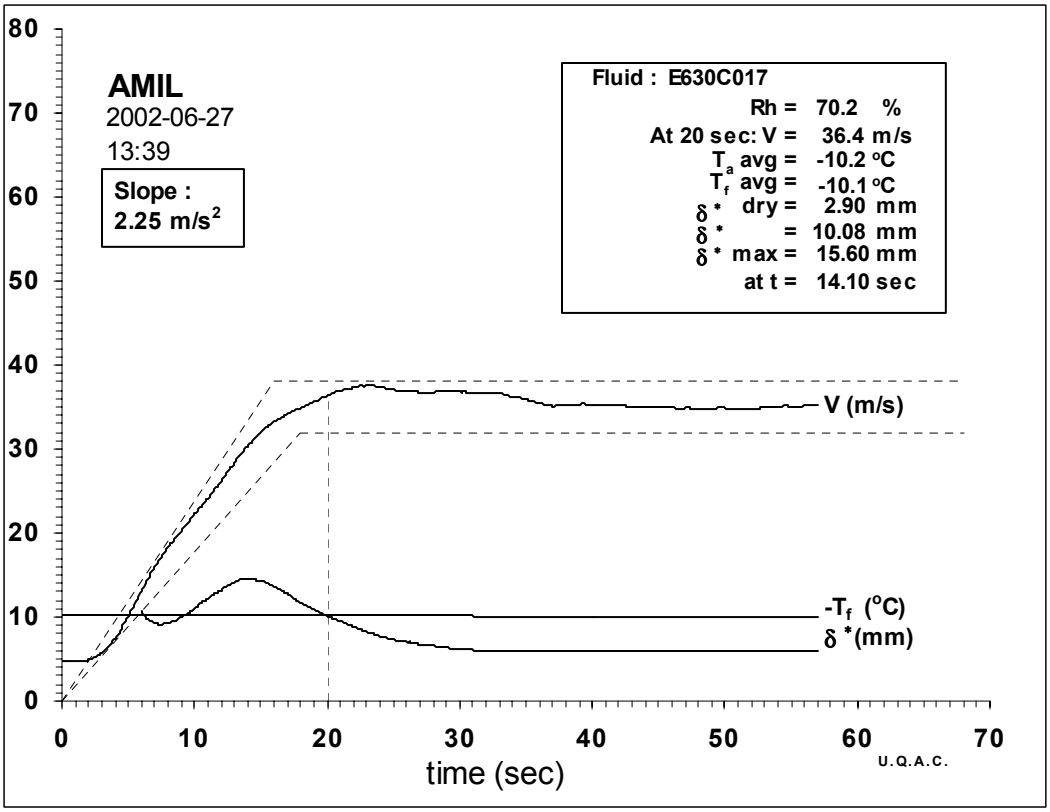
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-11.8	-10.2	63.1	3.74	37.4	0.58	10.37
20	-11.8	-10.2	62.9	3.80	37.7	0.54	9.85
21	-11.8	-10.2	63.0	3.69	37.1	0.48	9.31

Averages :

20	-11.8	**-10.2**	63.0	3.76	37.5	0.53	**9.82**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



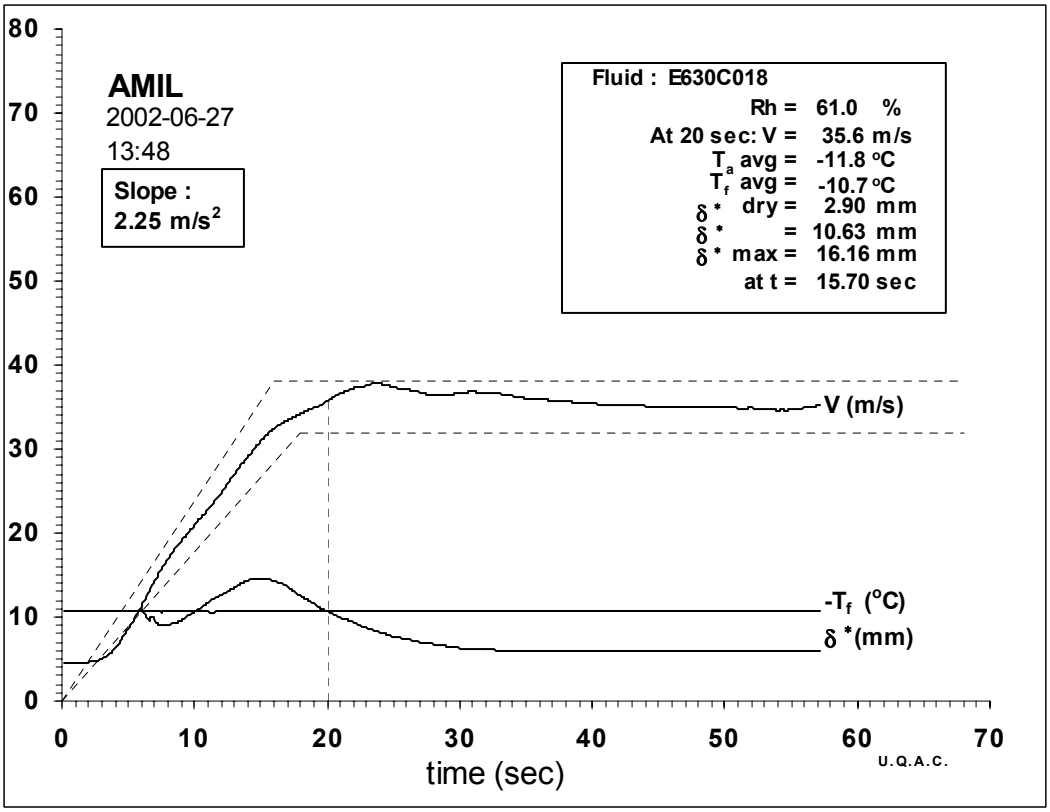
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-10.4	-10.2	72.5	3.47	36.1	0.56	10.61
20	-10.4	-10.2	69.4	3.46	36.0	0.50	9.99
21	-10.4	-10.2	69.6	3.72	37.4	0.52	9.80

Averages :

20	-10.4	**-10.2**	70.2	3.54	36.4	0.52	**10.08**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



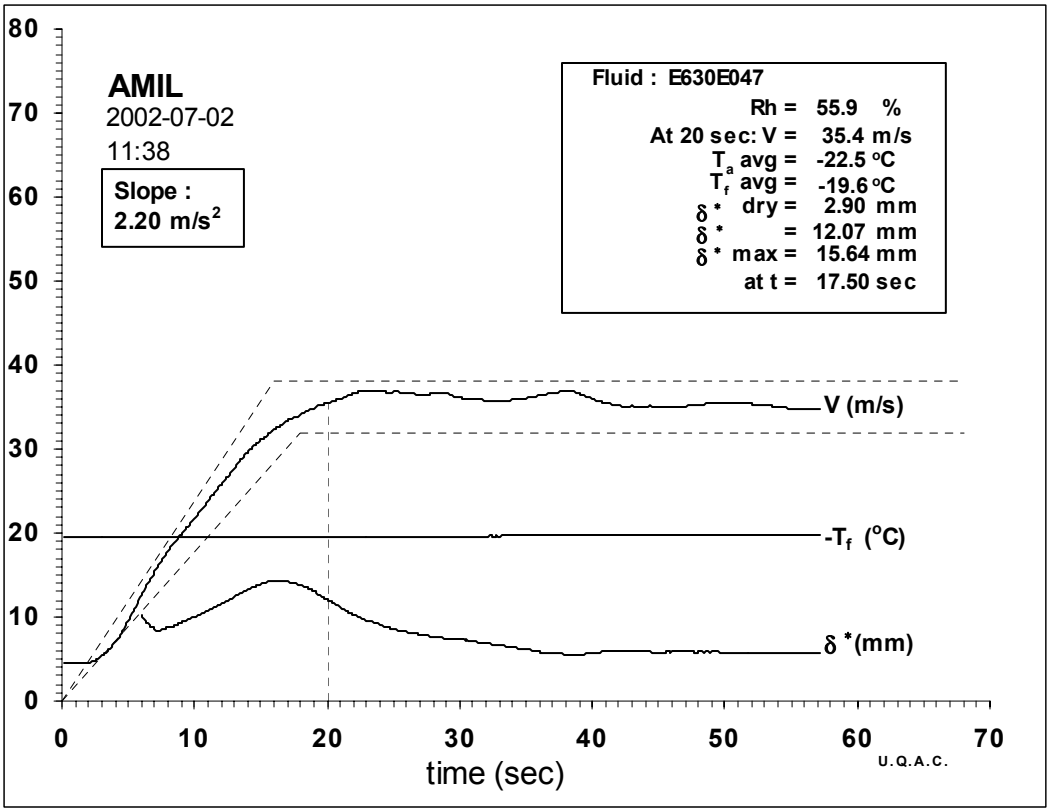
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-12.1	-10.7	61.0	3.16	34.3	0.51	10.70
20	-12.1	-10.7	60.7	3.43	35.8	0.57	10.87
21	-12.1	-10.7	61.4	3.57	36.5	0.53	10.16

Averages :

20	-12.1	**-10.7**	61.0	3.41	35.6	0.55	**10.63**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



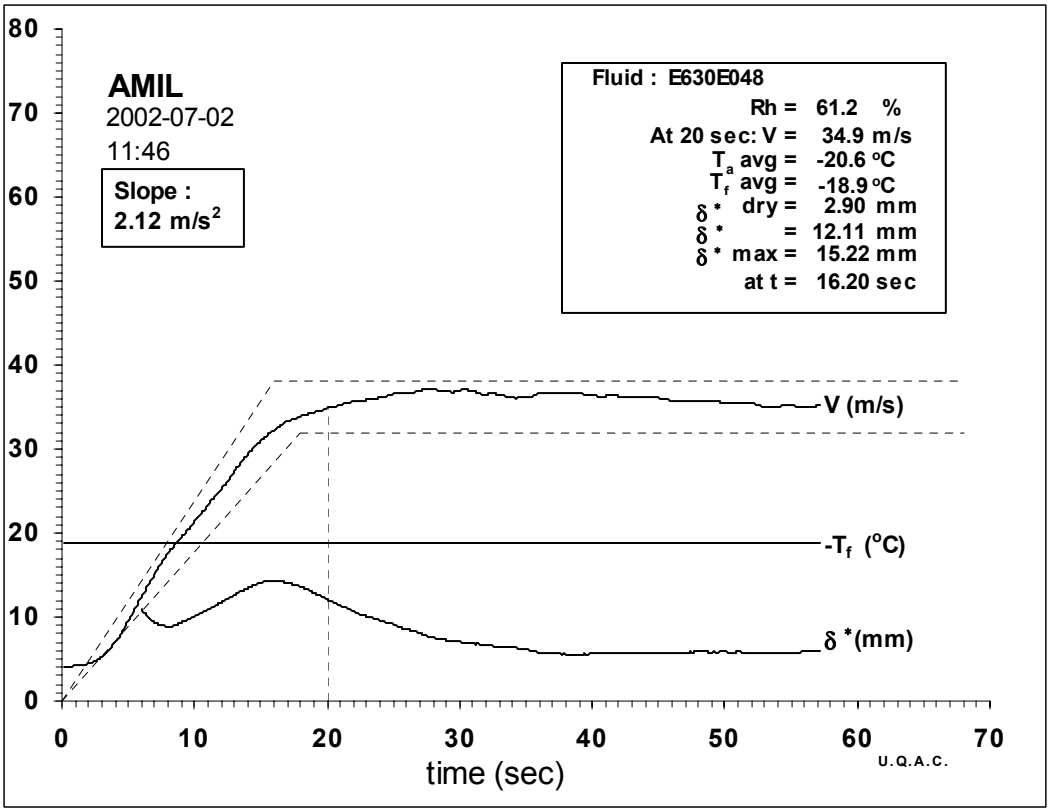
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-22.8	-19.5	54.7	3.32	34.5	0.71	12.76
20	-22.8	-19.5	55.8	3.56	35.7	0.71	12.13
21	-22.8	-19.5	57.0	3.57	35.7	0.64	11.41

Averages :

20	-22.8	**-19.5**	55.9	3.51	35.4	0.69	**12.07**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



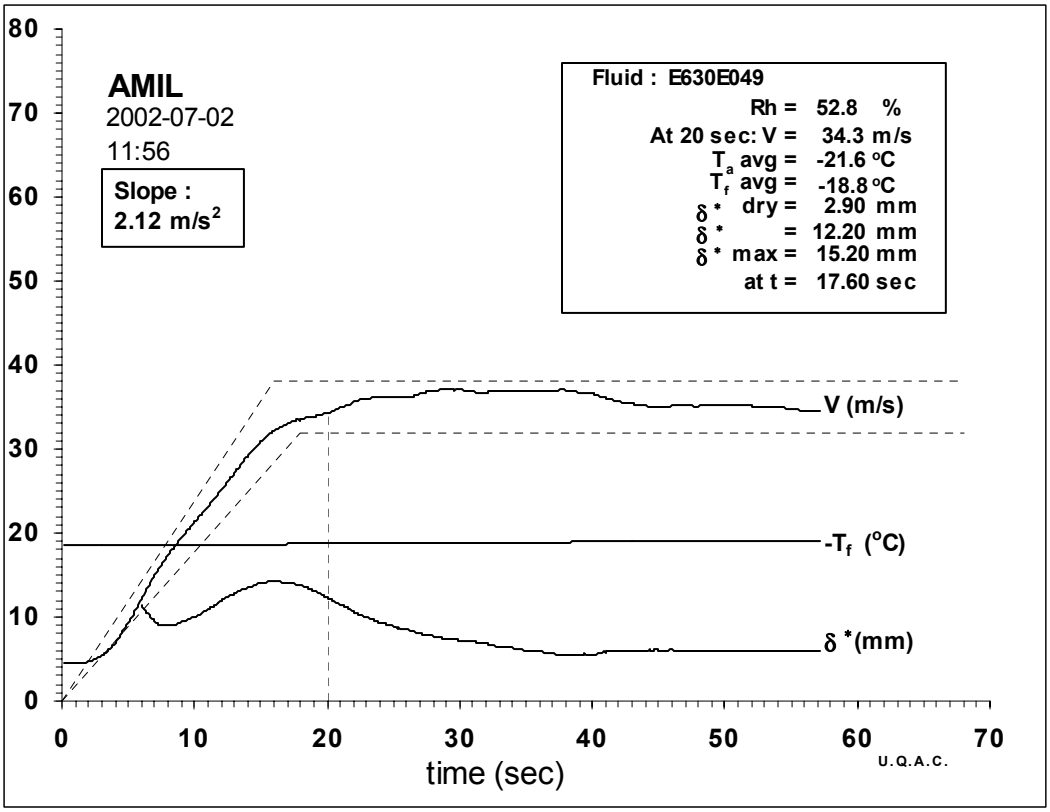
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-20.9	-18.8	61.1	3.29	34.4	0.70	12.65
20	-20.9	-18.8	61.5	3.42	35.1	0.68	12.15
21	-20.9	-18.9	60.8	3.38	34.9	0.62	11.58

Averages :

20	-20.9	**-18.8**	61.2	3.38	34.9	0.67	**12.11**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-22.0	-18.7	47.9	3.26	34.2	0.70	12.80
20	-22.0	-18.7	55.2	3.28	34.3	0.66	12.23
21	-22.0	-18.7	52.8	3.28	34.3	0.61	11.67

Averages :

20	-22.0	**-18.7**	52.8	3.27	34.3	0.66	**12.20**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm

B.19 DOW ULTRA+, LOT 200103528-53, 50/50 DILUTION E-631.

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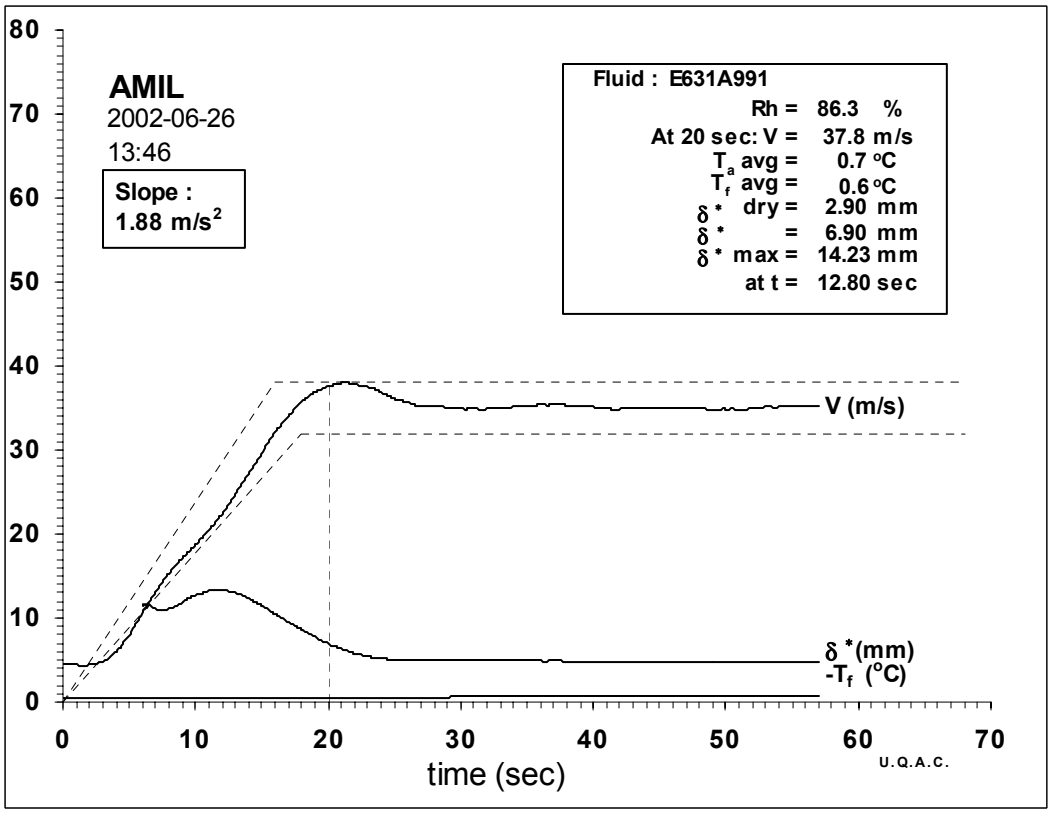


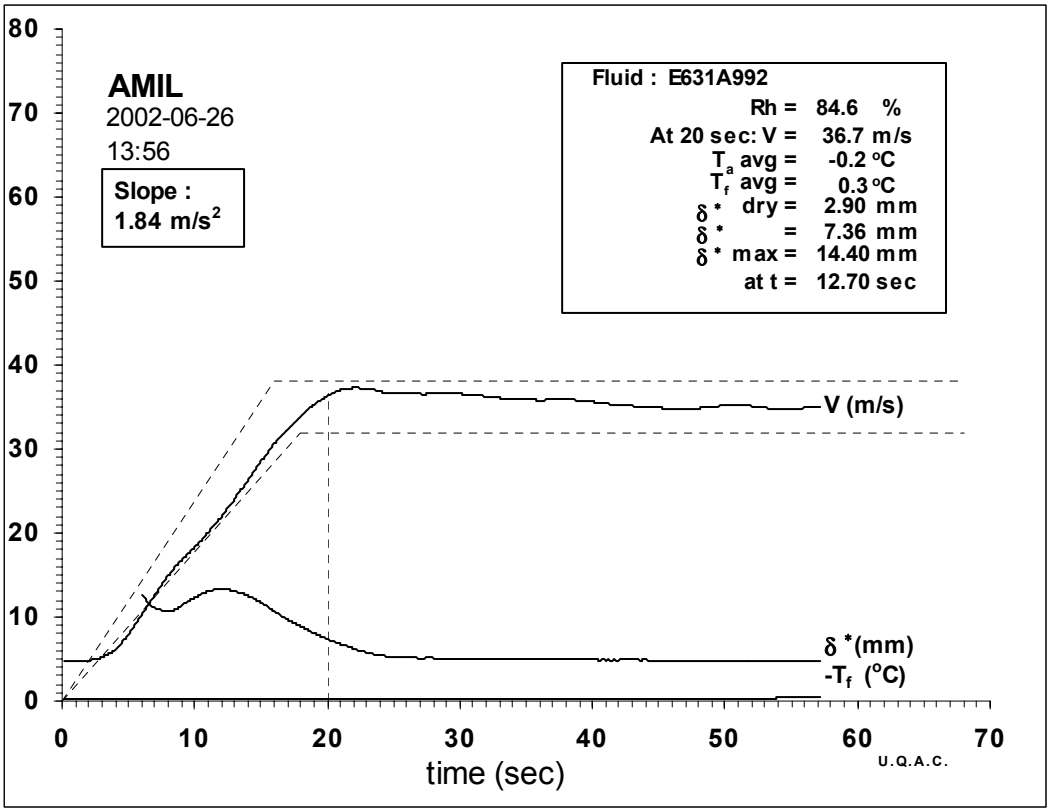
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	0.6	0.5	86.4	3.52	37.1	0.32	7.65
20	0.7	0.5	86.3	3.72	38.2	0.27	6.85
21	0.6	0.5	86.3	3.67	37.9	0.23	6.36

Averages :

20	0.6	**0.5**	86.3	3.66	37.8	0.27	**6.90**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



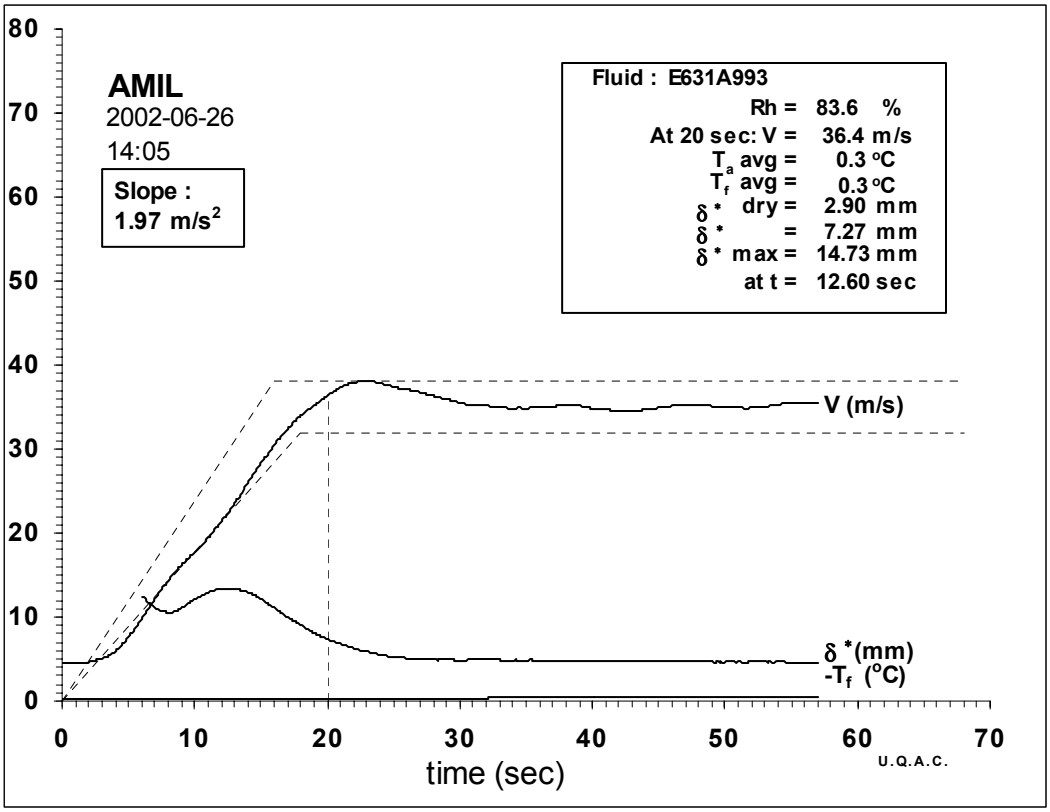
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	-0.3	0.2	84.3	3.22	35.4	0.31	7.90
20	-0.4	0.2	83.3	3.44	36.6	0.30	7.50
21	-0.3	0.2	87.1	3.66	37.8	0.25	6.69

Averages :

20	-0.3	**0.2**	84.6	3.45	36.7	0.29	**7.36**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



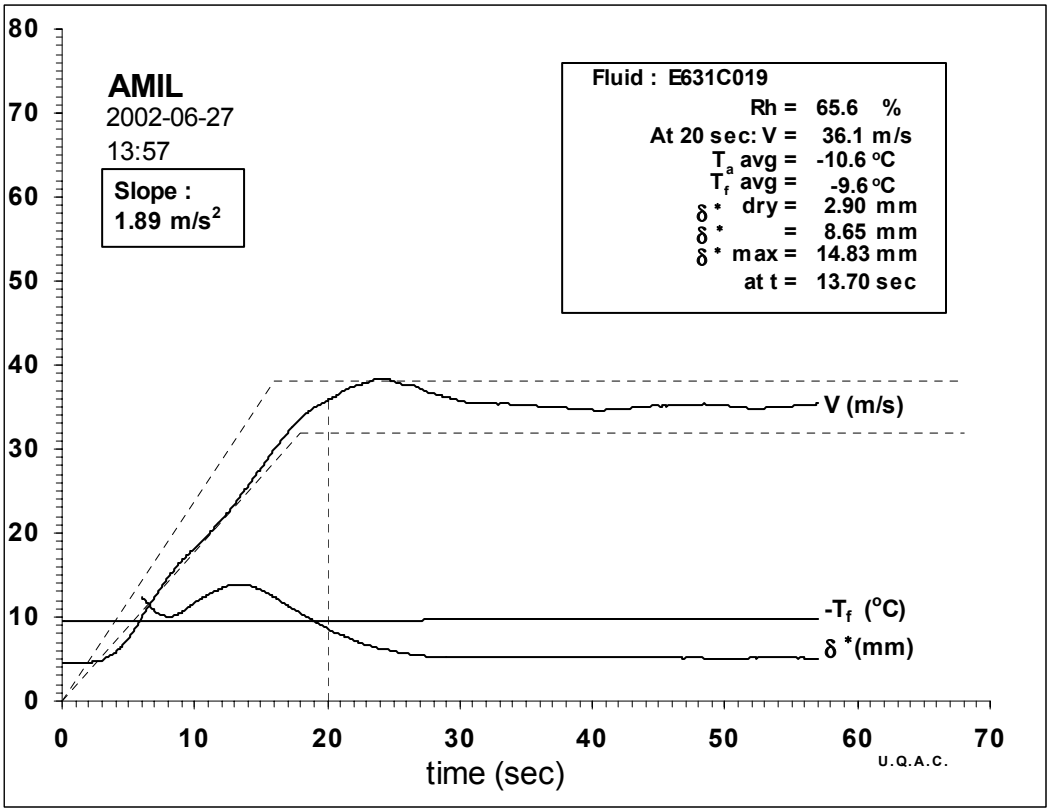
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ^* mm
19	0.1	0.3	77.3	3.25	35.6	0.31	7.87
20	0.2	0.3	84.4	3.42	36.6	0.28	7.30
21	0.2	0.3	87.6	3.44	36.7	0.24	6.71

Averages :

20	0.2	**0.3**	83.6	3.39	36.4	0.28	**7.27**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



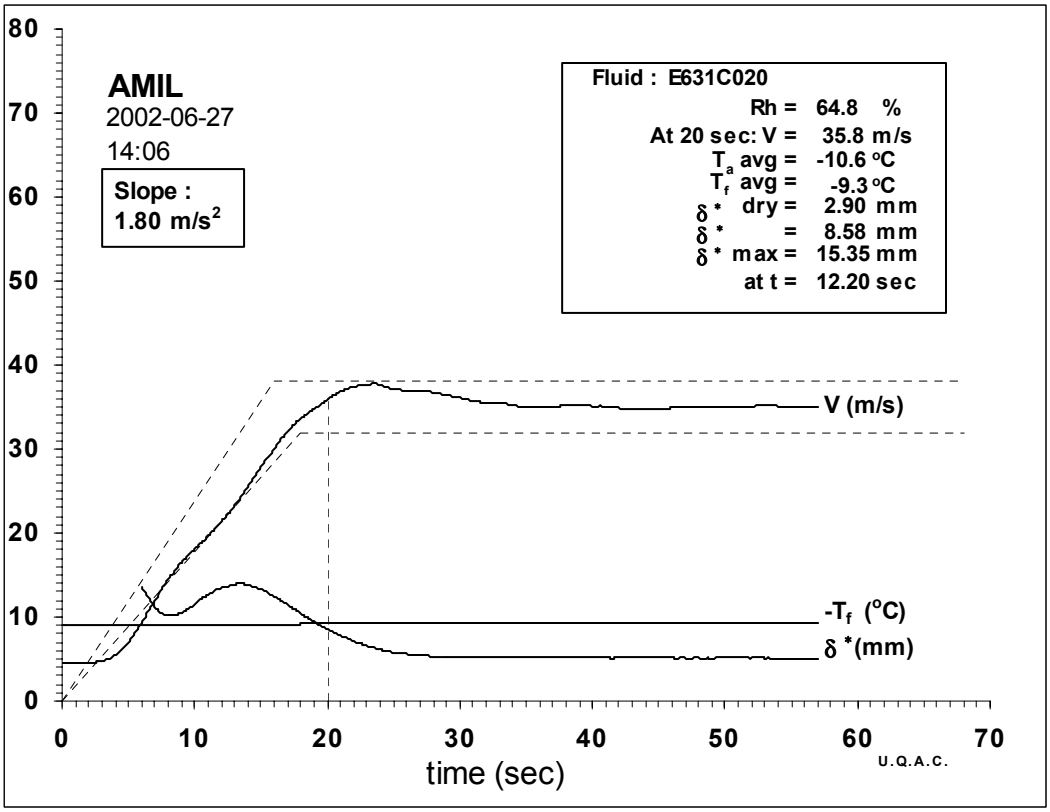
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.8	-9.6	63.5	3.35	35.4	0.43	9.27
20	-10.8	-9.6	64.9	3.49	36.1	0.40	8.71
21	-10.9	-9.6	68.4	3.56	36.5	0.35	8.05

Averages :

20	-10.8	**-9.6**	65.6	3.47	36.1	0.39	**8.65**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



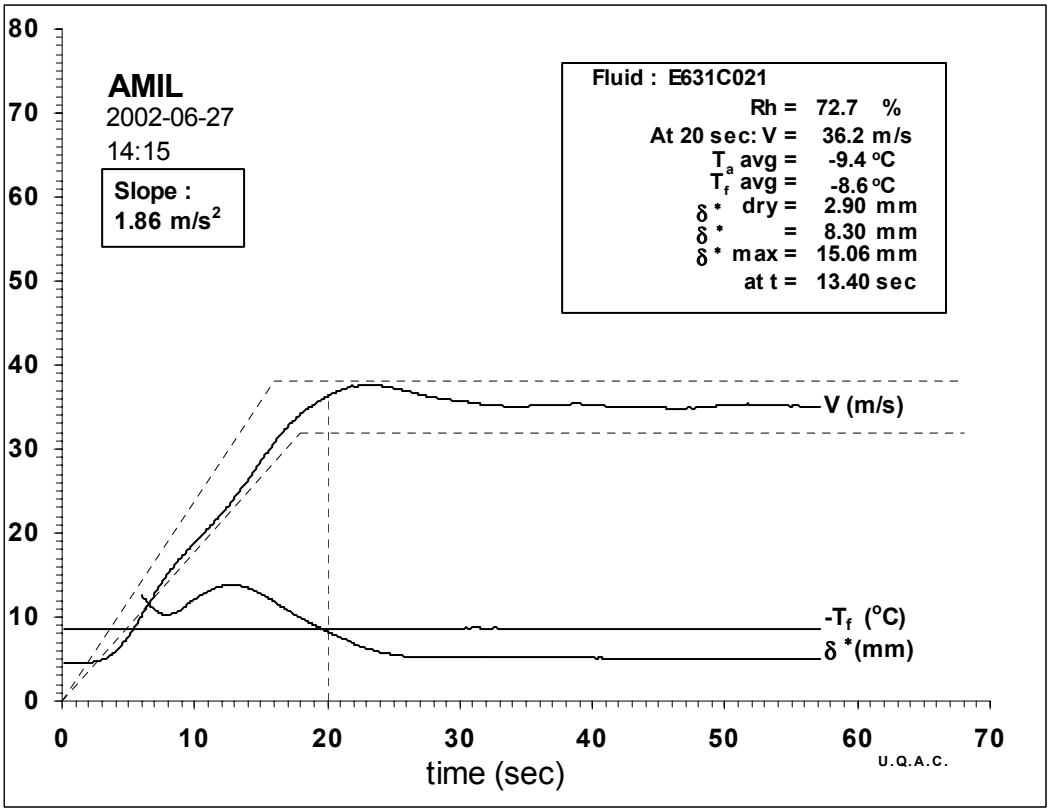
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-10.9	-9.2	67.4	3.27	35.0	0.42	9.35
20	-10.9	-9.2	64.2	3.45	35.9	0.38	8.55
21	-10.9	-9.2	63.7	3.53	36.4	0.35	7.99

Averages :

20	-10.9	**-9.2**	64.8	3.43	35.8	0.38	**8.58**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



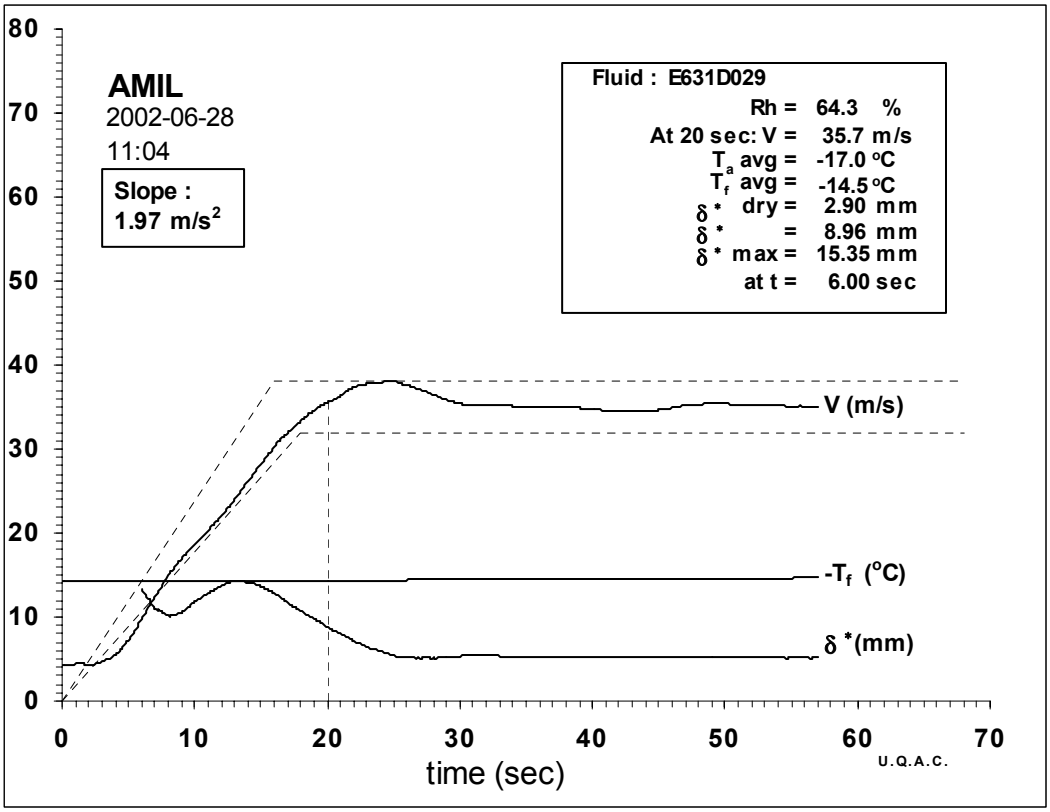
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-9.6	-8.7	74.7	3.28	35.1	0.37	8.66
20	-9.6	-8.6	72.4	3.56	36.6	0.39	8.52
21	-9.6	-8.7	71.7	3.55	36.6	0.32	7.64

Averages :

20	-9.6	**-8.7**	72.7	3.49	36.2	0.37	**8.30**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



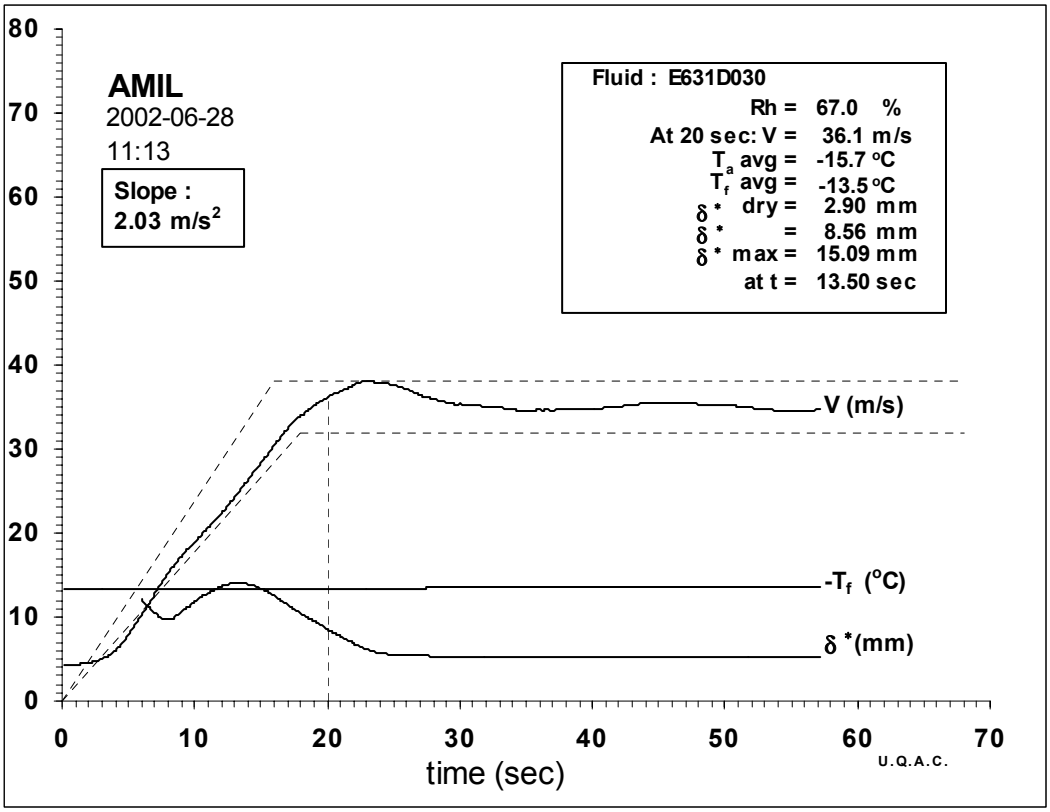
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-17.2	-14.3	63.2	3.24	34.4	0.43	9.50
20	-17.2	-14.4	65.8	3.54	36.0	0.43	9.03
21	-17.2	-14.3	62.8	3.64	36.5	0.39	8.42

Averages :

20	-17.2	**-14.3**	64.3	3.50	35.7	0.42	**8.96**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



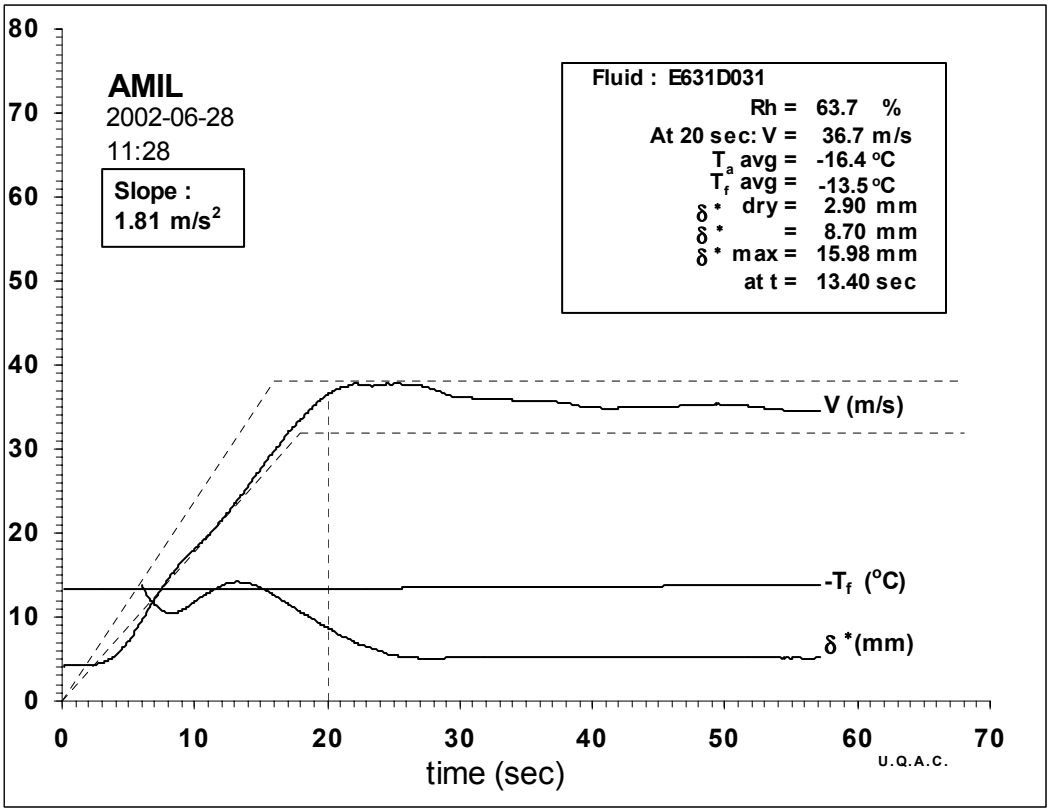
time Sec	T_a °C	T_f °C	Rh %	P_1-P_2 "H_2O	V m/s	P_2-P_3 "H_2O	δ * mm
19	-15.8	-13.4	65.2	3.52	36.0	0.45	9.22
20	-15.8	-13.4	69.2	3.41	35.4	0.37	8.39
21	-15.8	-13.4	64.8	3.78	37.3	0.40	8.29

Averages :

20	-15.8	**-13.4**	67.0	3.54	36.1	0.39	**8.56**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm



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	-16.7	-13.3	63.1	3.51	35.9	0.43	9.00
20	-16.6	-13.4	63.9	3.60	36.3	0.43	8.93
21	-16.6	-13.4	63.7	3.92	37.9	0.39	8.07

Averages :

20	-16.6	**-13.4**	63.7	3.67	36.7	0.42	**8.70**

Test Duct Dimensions :

S_2 = 30570.314 mm^2 S_3 = 33094.834 mm^2 B_3 = 301.82 mm C_3 = 822.97 mm