

**REPORT OF THE  
EVALUATION OF THE PAINT TRANSFER  
EFFICIENCY  
(BY WEIGHT) OF VARIOUS AIR GUNSA SPRAY  
GUNS  
CARRIED OUT BY  
THE MOTOR INSURANCE REPAIR  
RESEARCH CENTRE  
THATCHAM TRAINING  
AT THE REQUEST OF  
Anest Iwata Company**

Amended January 2002

T C Castle

**AUGUST 2001**

## Contents:

- REPORT NO TE001 AIR GUNSA AZ40
- REPORT NO TE002 AIR GUNSA AZ10
- FURTHER WORK ON THE EUROPEAN  
TEST METHOD

## **OBJECTIVE**

To determine the paint transfer efficiency (weight) of various Air Guns spray guns.

## **METHOD**

“Determination of the Transfer Efficiency of atomising and spraying equipment for liquid coating materials – Part 1: Flat Panels” produced as a European Standard by CEN. Document – EN 13966-1. Method 2 was used for the basis of the evaluation.

Paint materials used were all car refinish materials, 2K VHS Primer, water based base coat and 2KHS lacquer. All were EPA Stage 2 compliant, sprayed as one pass onto a vertically mounted aluminium foil, spraying time about 3 seconds. The foils were sprayed in a conventional down draft spray booth, keeping the spray within the area of the foil. (See Appendix A3 for further details)

Foils were pre-weighed and then re-weighed after coating and stoving to give ‘dry-up’ material. The spray gun was weighed before and after the paint application to determine ‘wet spray material’. To maintain a consistent gun distance from the foil, two parallel steel round bars were fixed across the front of the foil at a set distance so that by sliding the gun along the bars, a consistent spray distance and gun angle was maintained from the foil. Each aluminium foil was secured with clips to a steel backing panel and placed into a further spray booth on a steel backing panel for stoving. (Details of stoving are recorded on result sheets Appendix B5)

Before evaluation began, paint fluid flow, viscosity, temperature and solids were measured and after test the viscosity and paint temperature were re-measured. (See Appendix B4 for method)

After stoving the fan widths were measured at three positions on each foil. (See Appendix B3)

All tests were carried out within half of the ‘pot life’ of each paint.

## **RESULTS**

The results of each spray gun are reported under a different Report Number enclosed: -

Report No TE001 results on the Air Guns AZ40 Gravity Gun  
Report No TE002 results on the Air Guns AZ10 Suction Gun

At the back of this Report are the results and conclusion on the solids determination in reference to the European Test Method.

## **CONCLUSION**

The Air Guns AZ40 – Report No TE001

The Air Guns AZ10 – Report No TE002

Spray guns achieved a transfer efficiency (weight) greater than 65% when used as detailed in the reports.

# LIST OF APPENDICES FOR ALL REPORTS

- A1 Summary of Results T.E. % by weight
- A2 Transfer Efficiency (T.E.) Calculations
- A3
  - a) Position of Panels in Spray Booth
  - b) Foil Test Sample – Size and Area Sprayed
- B1 Variables assessed
- B2 Materials used in Transfer Efficiency Tests and mix ratios
- B3 Fan width results
- B4 Method for: Material Solids  
Viscosity  
Paint Fluid Flow
- B5 Test Report Sheets
- B6 Investigation in 'solids' determination

# **REPORT TE001**

## **AIR GUNSA AZ40 GRAVITY GUN**

**August 2001**

**TE001**

**APPENDIX A1**

**SUMMARY OF RESULTS T.E.% (BY WEIGHT)**

<b>MATERIAL</b>	<b>AIR GUNSA AZ40</b>	
	<b>Nozzle 1.2mm</b>	<b>Nozzle 1.5mm</b>
Water Based Base Coat	72.1	-
2K HS Lacquer	-	75.7
2K VHS Primer	-	93.0

**TE001**

**APPENDIX A2**

**TRANSFER EFFICIENCY (T.E.)  
CALCULATIONS (WEIGHT)**

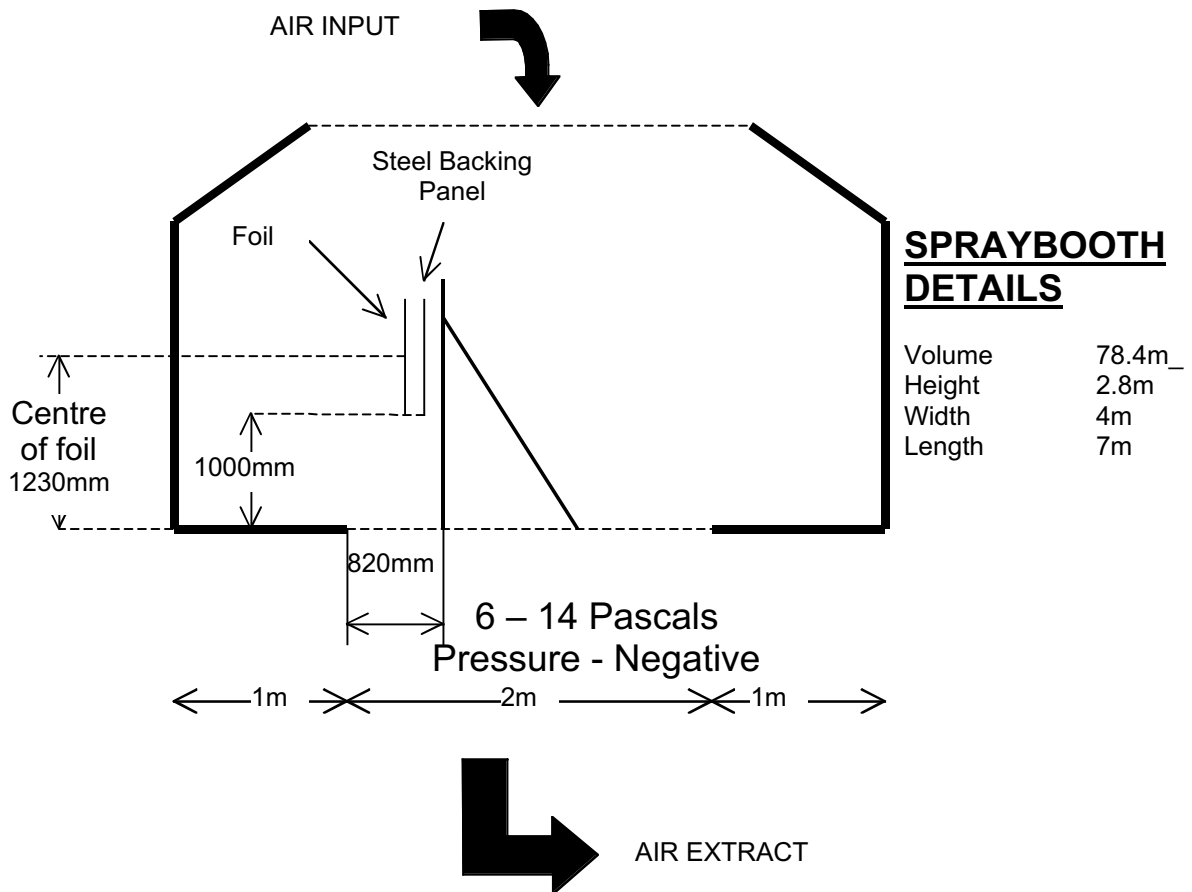
1. Weight of Foil Panel
2. Weight of Foil Panel + 'Dry-up'
3.  $(2-1)$  = Weight of 'Dry-up'
4. Wet Spray Material  
i.e. Gun weighed before and after application – weight difference
5. Spray Solid =  $(4 \times \text{Av. Mat. Solids})$
6. T.E. (weight) =  $(3/5) \times 100\%$



TE001

APPENDIX A3a

POSITION OF TEST PANELS IN SPRAYBOOTH

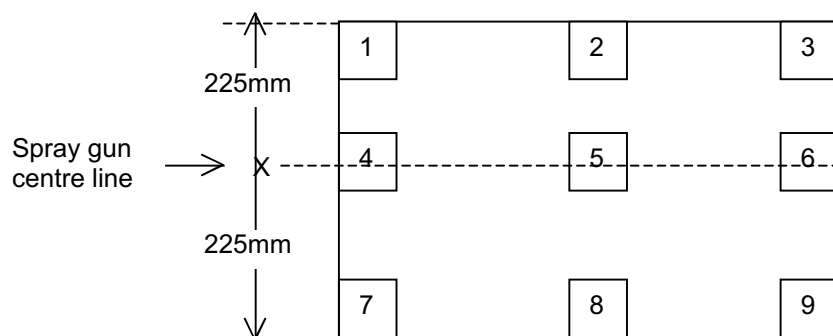


DOWN DRAFT AIR MOVEMENT OVER TEST PANEL

Airflow tests on spray jig (Garmat GSC91, 20°C)

Point Average reading

1	0.29m/s
2	0.29m/s
3	0.29m/s
4	0.29m/s
5	0.29m/s
6	0.22m/s
7	0.31m/s
8	0.32m/s
9	0.29m/s

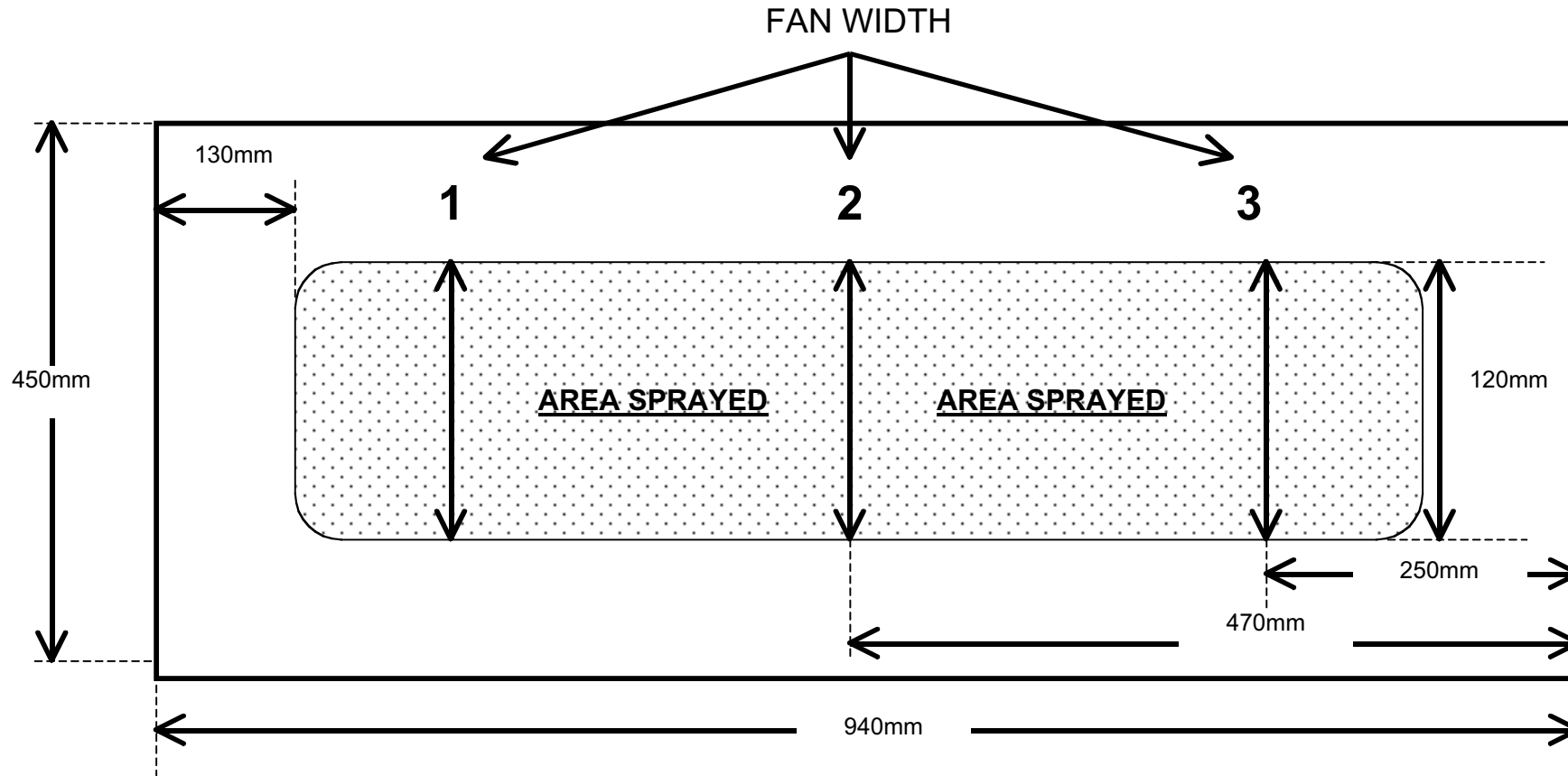


All measurements taken with meter reset and 30 secs allowance for inertia

TE001

APPENDIX A3b

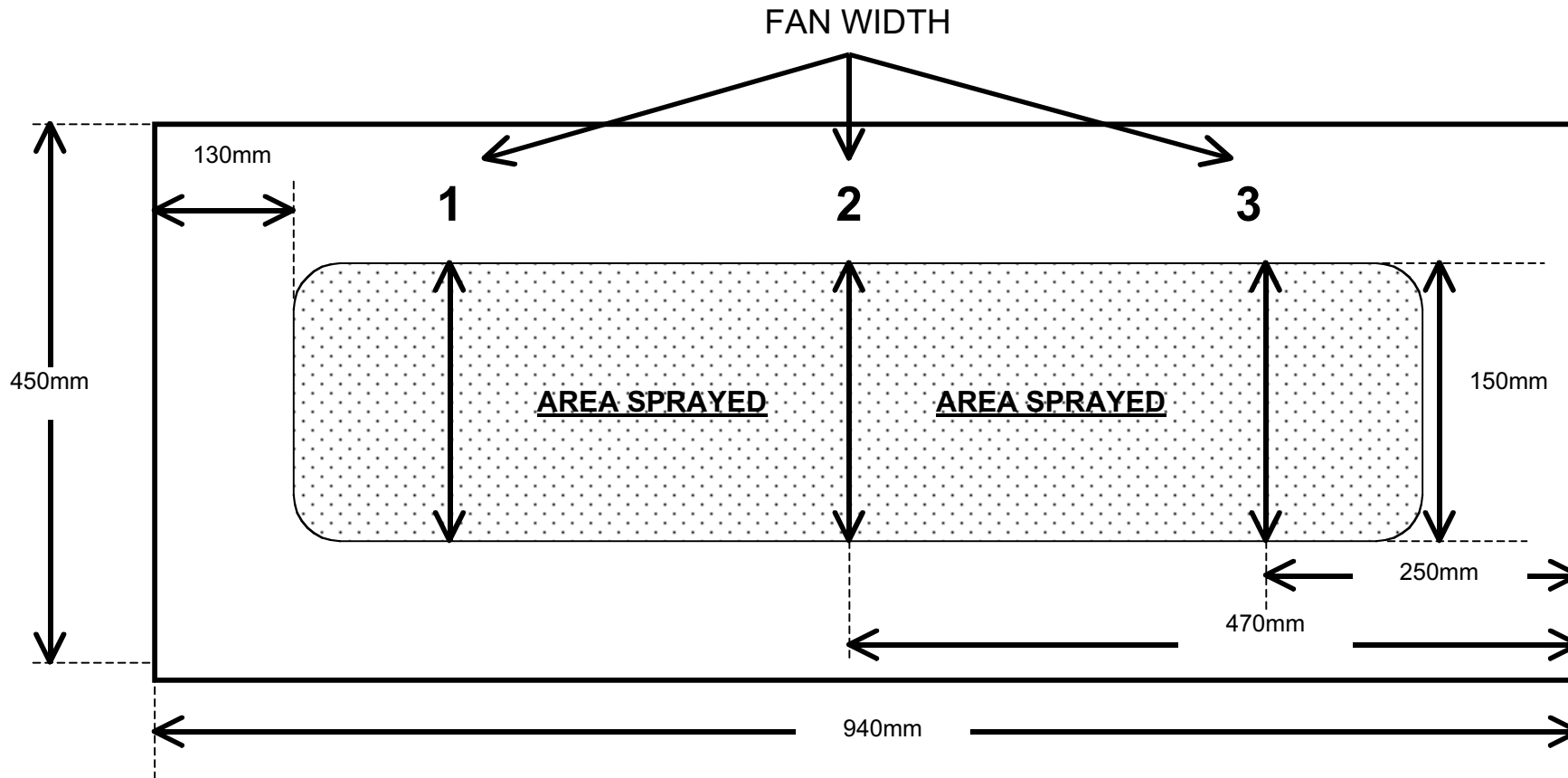
FOIL TEST SAMPLE SIZE, AREA SPRAYED AND  
LOCATION OF FAN WIDTH MEASUREMENT  
2K VHS PRIMER



TE001

APPENDIX A3b Continued

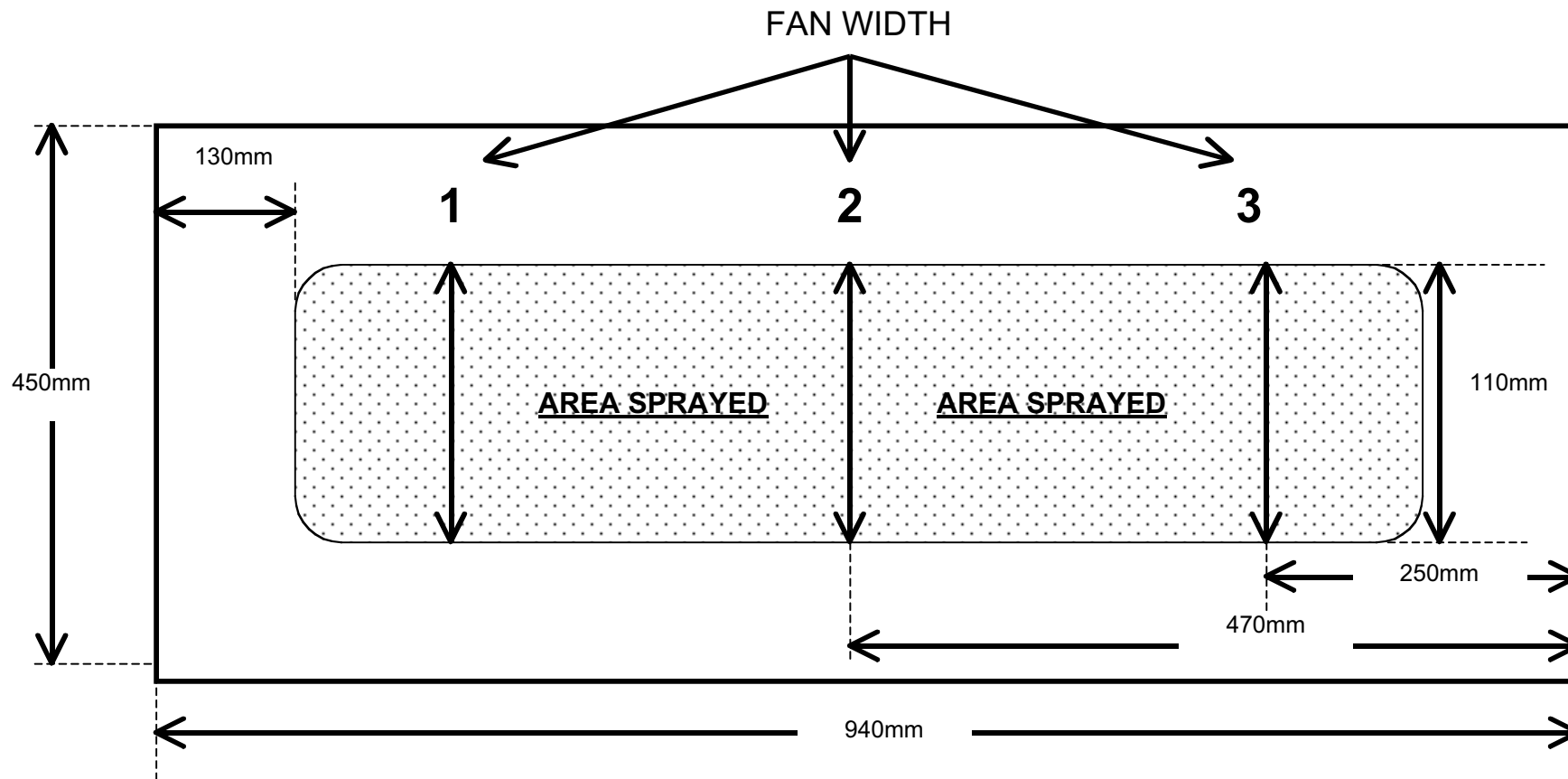
FOIL TEST SAMPLE SIZE, AREA SPRAYED AND  
LOCATION OF FAN WIDTH MEASUREMENTS  
2K HS LACQUER



TE001

APPENDIX A3b Continued

FOIL TEST SAMPLE SIZE, AREA SPRAYED AND  
LOCATION OF FAN WIDTH MEASUREMENT  
WATER BASED BASE COAT



**TE001**

**APPENDIX B1**

**VARIABLES ASSESSED**

**TE003**

AZ40 Gravity Gun	Nozzle 1.5mm	–	2KVHS Primer 2KHS Lacquer
	Nozzle 1.2mm	–	Water Based Base Coat

**TE001  
APPENDIX B2**

**MATERIALS USED IN TRANSFER EFFICIENCY TESTS  
AND MIX RATIOS**

**2K PRIMER**

Standex VHS Fuller	02081938	2200064	038
Standex Fuller Harter	02081555	2808679	048
Standex Fuller Thinner	8020541	2020520	026

**Mix Ratio**            372g VHS Fuller  
                             109g Fuller Harter  
                             18g 2K Thinner

**2K LACQUER**

Standex 2K HS Lacquer	02082497	4135431	031
Standex 2K HS Hardener 15-25	02085062	4099913	100

**Mix Ratio**    100g            HS Lacquer  
                     50g                Hardener HS 15-25

**WATER BASED BASE COAT**

Standex Standohyde – Vauxhall Oriental Blue 24L

Mix No            99795-900

Standohyde V.E. Wasser

**Mix Ratio**    1528.1g Base Coat  
                     152g V.E. Wasser

TE001

APPENDIX B3

FAN WIDTH RESULTS GUN DISTANCE 15 cm

		<u>Fan Width</u>				
		<u>Gun</u>	<u>AIR GUNSA AZ40</u>			<u>Width</u>
			Position (cms)			
<b>Material</b>	<b>Setup</b>	<b>Foil No</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Average</b>
2K VHS Primer	1.5mm 2 Bar	4A	13	13	12	12
		4B	12	12	12	
		4C	12	11	12	
		4D	12.5	12	12	
2K HS Lacquer	1.5mm 2 Bar	5A	15.5	15.5	15.5	15
		5B	15	15	15.5	
		5C	15.5	15	15.5	
		5D	14.5	14.5	15	
Base Coat	1.2mm 2 Bar	6A	11	11	11	11
		6B	11	11	11	
		6C	12	12	12	
		6D	11	11	11	

## TE001

### APPENDIX B4

#### MATERIAL SOLIDS

Paint was weighed into a pre-weighed round aluminium foil dish (Approx. 17cm diameter). By tipping the dish the paint was allowed to run and cover the bottom. Stoving was carried out at the temperature and times recommended by the paint manufacturer to cure their paints, as stated in the European Test Method. For stoving conditions of the water based base coat, see the result sheets. Both the foils and solid dishes were stoved together.

After stoving the dishes were allowed to cool and were re-weighed.

Calculations:

1. Aluminium dish weight
2. Wet material weight
3. 'Dry-up' material & dish weight
4. 'Dry-up' weight = (3 – 1)
5. Material solids = (4÷2)

#### Note

All paint was mixed by weight. This was considered a more accurate way of mixing than by volume.

#### VISCOSITY

The viscosity was tested using a DIN 4 Cup

#### PAINT FLUID FLOW THROUGH THE GUN

After setting up the gun it was weighed, the paint sprayed for 15 seconds in the booth and the gun re-weighed. Weight difference gave paint fluid flow for 15 seconds.



# TE001

## APPENDIX B5

### RESULT SHEET

Date: 29.08.01

1. **Materials:** 2KVHS Primer  
**Viscosity:** **Start:** 23s at 26°C  
**Spray Temp:** 27°C  
**Spray Humidity:** 43%  
**Fan Width Average:** 12cm

**Finish:** 43s at 26°C

**Stoving Schedule** **Foil:** } 60°C for 60 minutes  
**Solids Temp/Time** **Foil Tray:** }

### 2. Material Solids (Tray)

Panel Dish No	1	2	3	4 (3-1)	5 (4/2)	6
	Aluminium Foil Tray Weight (g)	Wet Material	Dry up Foil Tray Weight (g)	Dry Up (g)	Materials Solid (g)	Average Material Solids (g)
4A	10.489	1.914	12.128	1.639	0.8563	0.8555
4B	10.349	1.661	11.768	1.419	0.8543	
4C	10.424	1.658	11.843	1.419	0.8559	

### 3. Transfer Efficiency (T.E.) on Foil

Foil No	Gun Model	Paint Adj	Pressure at Gun	Spray Distance	Foil Position	No of Gun Passes	Paint Output g/min	1	2	3 (2-1)	4	5 (4x6)	6 (3/5)	T.E. Av %
								Foil Weight	Dry up & Foil	Dry Up	Wet Spray Material	Spray Solid	T.E.	
4A	AZ40	F/O	2 Bar	15cm	Vert	One	157	11.804	17.377	5.573	7.04	6.023	92.5	93.0
4B	AZ40	F/O	2 Bar	15cm	Vert	One	157	11.900	15.666	3.766	4.76	4.072	92.5	
4C	AZ40	F/O	2 Bar	15cm	Vert	One	157	11.873	15.392	3.519	4.40	3.764	93.5	
4D	AZ40	F/O	2 Bar	15cm	Vert	One	157	11.731	15.740	4.009	5.02	4.295	93.3	

F/O = FULLY OPEN

# TE001

## APPENDIX B5 (Cont'd)

### RESULT SHEET

Date: 30.08.01

1. **Materials:** 2K HS Lacquer  
**Viscosity:** Start: 22s at 22°C      **Finish:** 27s at 24°C  
**Spray Temp:** 21°C  
**Spray Humidity:** 55%  
**Fan Width Average:** 15cm
- Stoving Schedule**      **Foil:** }  
**Solids Temp/Time**      **Foil Tray:** } 60°C for 30 minutes
4. **Material Solids (Tray)**

Panel Dish No	1	2	3	4 (3-1)	5 (4/2)	6
	Aluminium Foil Tray Weight (g)	Wet Material	Dry up Foil Tray Weight (g)	Dry Up (g)	Materials Solid (g)	Average Material Solids (g)
5A	10.559	1.623	11.466	0.907	0.5588	0.5668
5B	10.478	1.677	11.440	0.962	0.5736	
5C	10.491	1.741	11.480	0.989	0.5681	

### 5. Transfer Efficiency (T.E.) on Foil

Foil No	Gun Model	Paint Adj	Pressure at Gun	Spray Distance	Foil Position	No of Gun Passes	Paint Output g/min	1	2	3 (2-1)	4	5 (4x6)	6 (3/5)	T.E. Av %
								Foil Weight	Dry up & Foil	Dry Up	Wet Spray Material	Spray Solid	T.E.	
5A	AZ40	F/O	2 Bar	15cm	Vert	One	153	12.181	14.755	2.574	5.96	3.378	76.2	75.7
5B	AZ40	F/O	2 Bar	15cm	Vert	One	153	11.918	14.082	2.164	5.00	2.834	76.4	
5C	AZ40	F/O	2 Bar	15cm	Vert	One	153	12.060	14.273	2.213	5.21	2.953	74.9	
5D	AZ40	F/O	2 Bar	15cm	Vert	One	153	11.988	14.067	2.079	4.88	2.766	75.2	

F/O = FULLY OPEN

# TE001

## APPENDIX B5 (Cont'd)

### RESULT SHEET

Date: 30.08.01

1. **Materials:** Water Based Base Coat  
**Viscosity:** Start: 23s at 22°C      **Finish:** 23s at 23°C  
**Spray Temp:** 22°C  
**Spray Humidity:** 54%  
**Fan Width Average:** 11cm
- Stoving Schedule**      **Foil:** } 40°C for 25 minutes (spray cycle)  
**Solids Temp/Time**      **Foil Tray:** } 60°C for 20 minutes (Bake cycle)
6. **Material Solids (Tray)**

Panel Dish No	1	2	3	4 (3-1)	5 (4/2)	6
	Aluminium Foil Tray Weight (g)	Wet Material	Dry up Foil Tray Weight (g)	Dry Up (g)	Materials Solid (g)	Average Material Solids (g)
6A	10.485	1.793	10.808	0.323	0.1801	0.1783
6B	10.376	1.704	10.677	0.301	0.1766	
6C	10.423	1.711	10.728	0.305	0.1783	

### 7. Transfer Efficiency (T.E.) on Foil

Foil No	Gun Model	Paint Adj	Pressure at Gun	Spray Distance	Foil Position	No of Gun Passes	Paint Output g/min	1	2	3 (2-1)	4	5 (4x6)	6 (3/5)	T.E. Av %
								Foil Weight	Dry up & Foil	Dry Up	Wet Spray Material	Spray Solid	T.E.	
6A	AZ40	F/O	2 Bar	15cm	Vert	One	106	12.667	13.322	0.655	5.05	0.900	72.8	72.1
6B	AZ40	F/O	2 Bar	15cm	Vert	One	106	12.654	13.180	0.526	4.11	0.733	71.8	
6C	AZ40	F/O	2 Bar	15cm	Vert	One	106	12.656	13.340	0.694	5.43	0.968	71.7	
6D	AZ40	F/O	2 Bar	15cm	Vert	One	106	12.542	13.085	0.543	4.22	0.752	72.2	

F/O = FULLY OPEN

# **REPORT TE002**

## **AIR GUNSA AZ10 SUCTION GUN**

**August 2001**

**TE002**

**APPENDIX A1**

**SUMMARY OF RESULTS T.E.% (BY WEIGHT)**

<b>MATERIAL</b>	<b>AIR GUNSA AZ10</b>	
	<b>Nozzle 1.5mm</b>	<b>Nozzle 1.8mm</b>
Water Based Base Coat	79.7	-
2K HS Lacquer	76.7	-
2K VHS Primer	-	93.5

## TE002

### APPENDIX A2

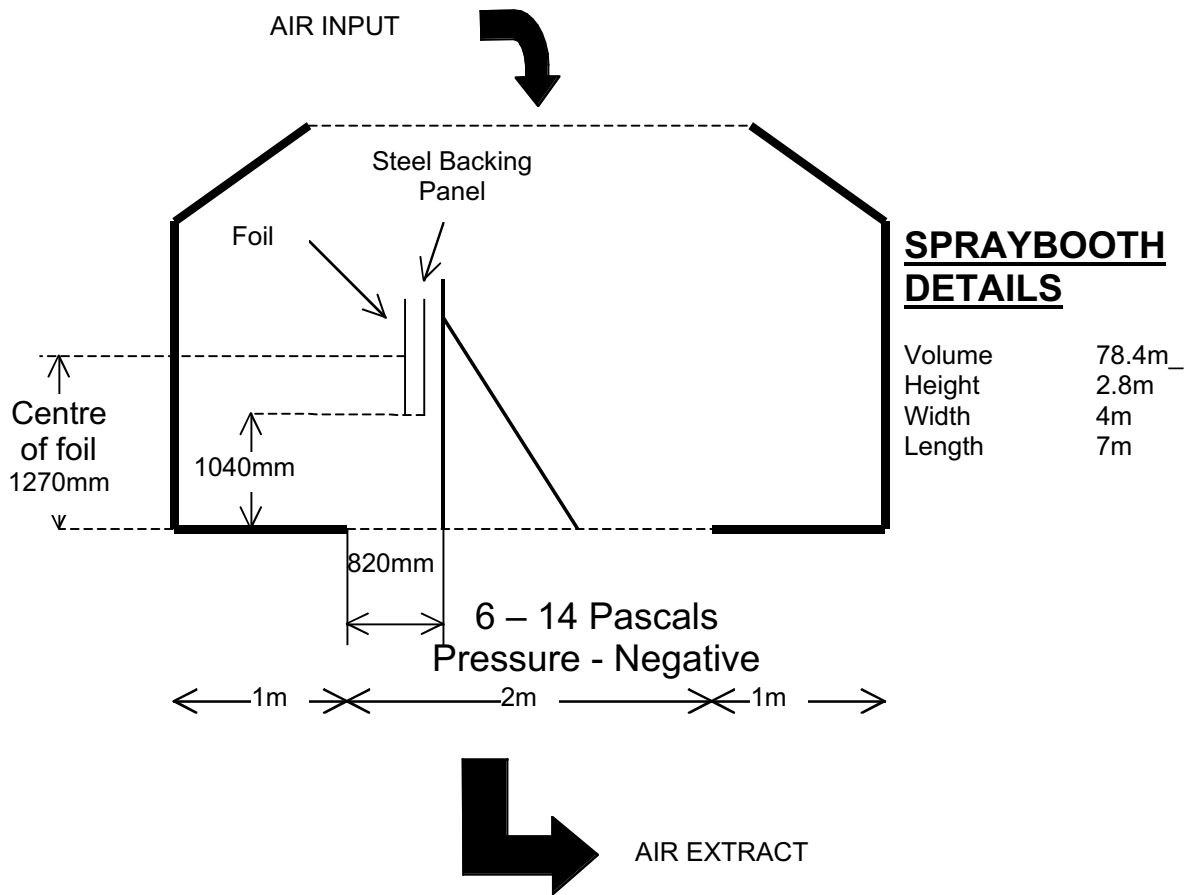
#### TRANSFER EFFICIENCY (T.E.) CALCULATIONS (WEIGHT)

1. Weight of Foil Panel
2. Weight of Foil Panel + 'Dry-up'
3.  $(2-1)$  = Weight of 'Dry-up'
4. Wet Spray Material  
i.e. Gun weighed before and after application – weight difference
5. Spray Solid =  $(4 \times \text{Av. Mat. Solids})$
6. T.E. (weight) =  $(3/5) \times 100\%$

TE002

APPENDIX A3a

POSITION OF TEST PANELS IN SPRAYBOOTH

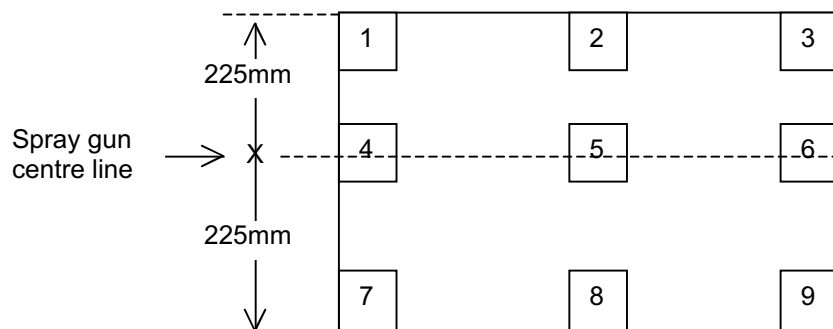


DOWN DRAFT AIR MOVEMENT OVER TEST PANEL

Airflow tests on spray jig (Garmat GSC91, 20°C)

Point Average reading

1	0.29m/s
2	0.29m/s
3	0.29m/s
4	0.29m/s
5	0.29m/s
6	0.22m/s
7	0.31m/s
8	0.32m/s
9	0.29m/s

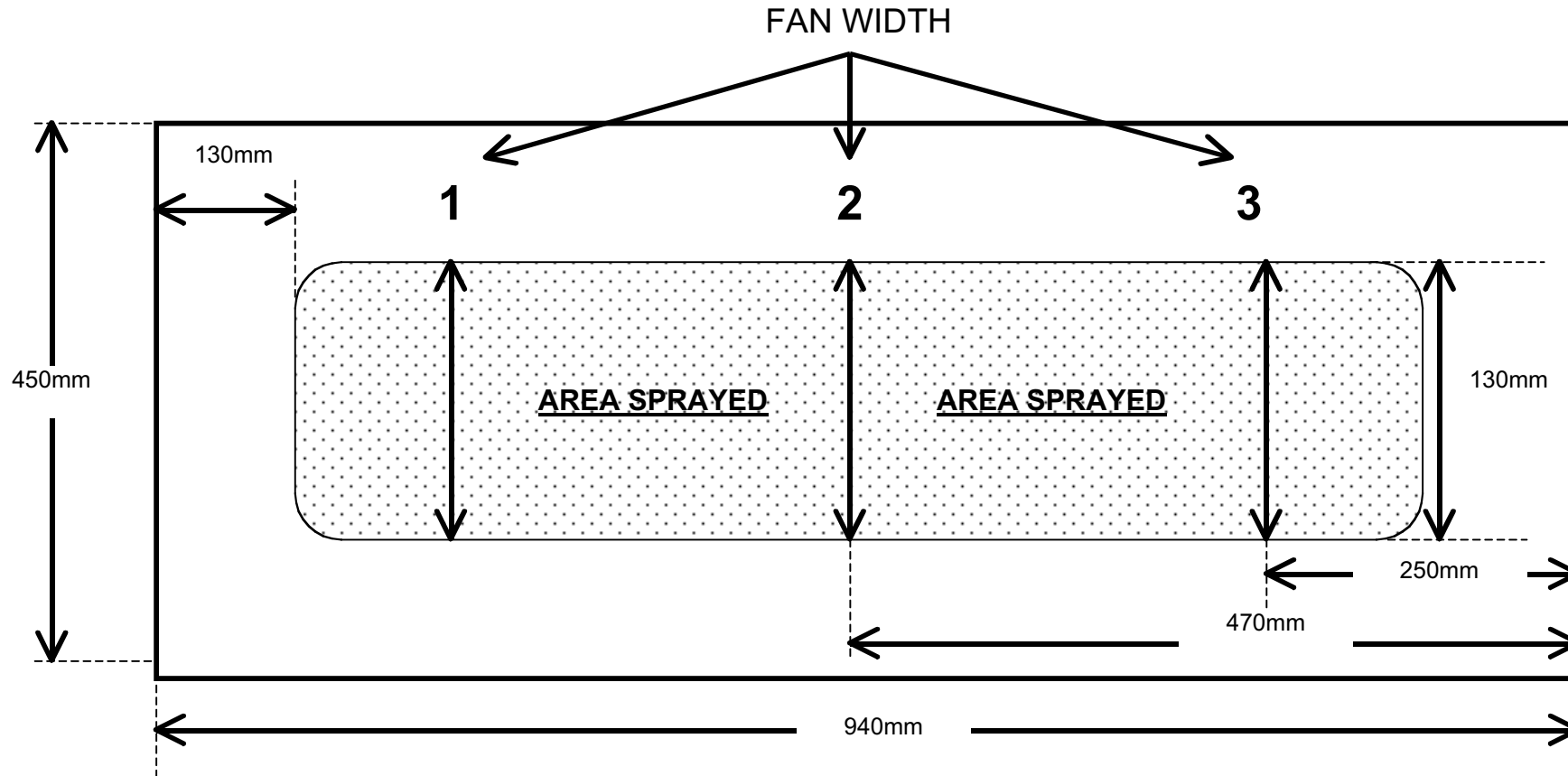


All measurements taken with meter reset and 30 secs allowance for inertia

TE002

APPENDIX A3b

FOIL TEST SAMPLE SIZE, AREA SPRAYED AND  
LOCATION OF FAN WIDTH MEASUREMENT  
2K VHS PRIMER

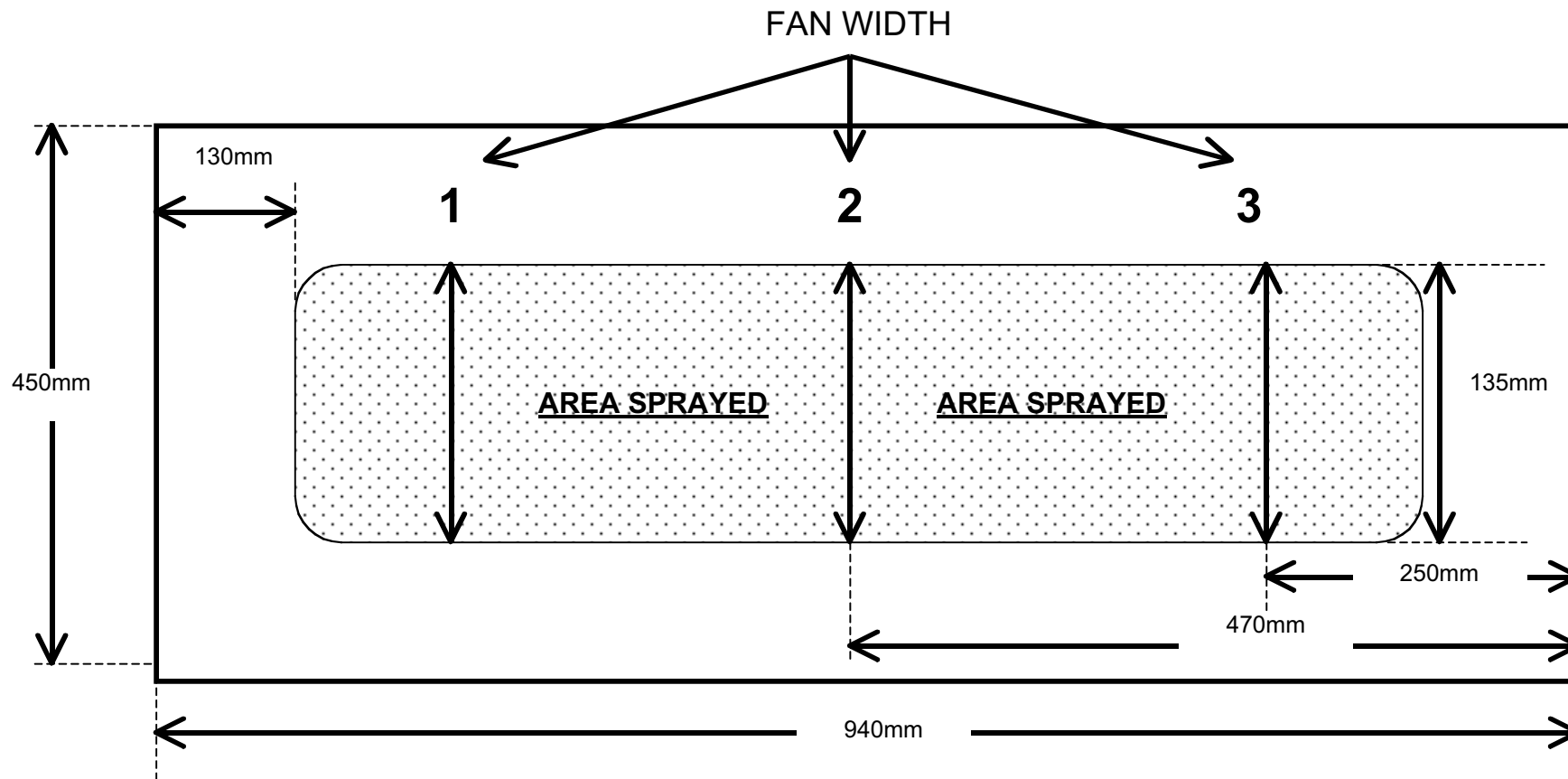




TE002

APPENDIX A3b Continued

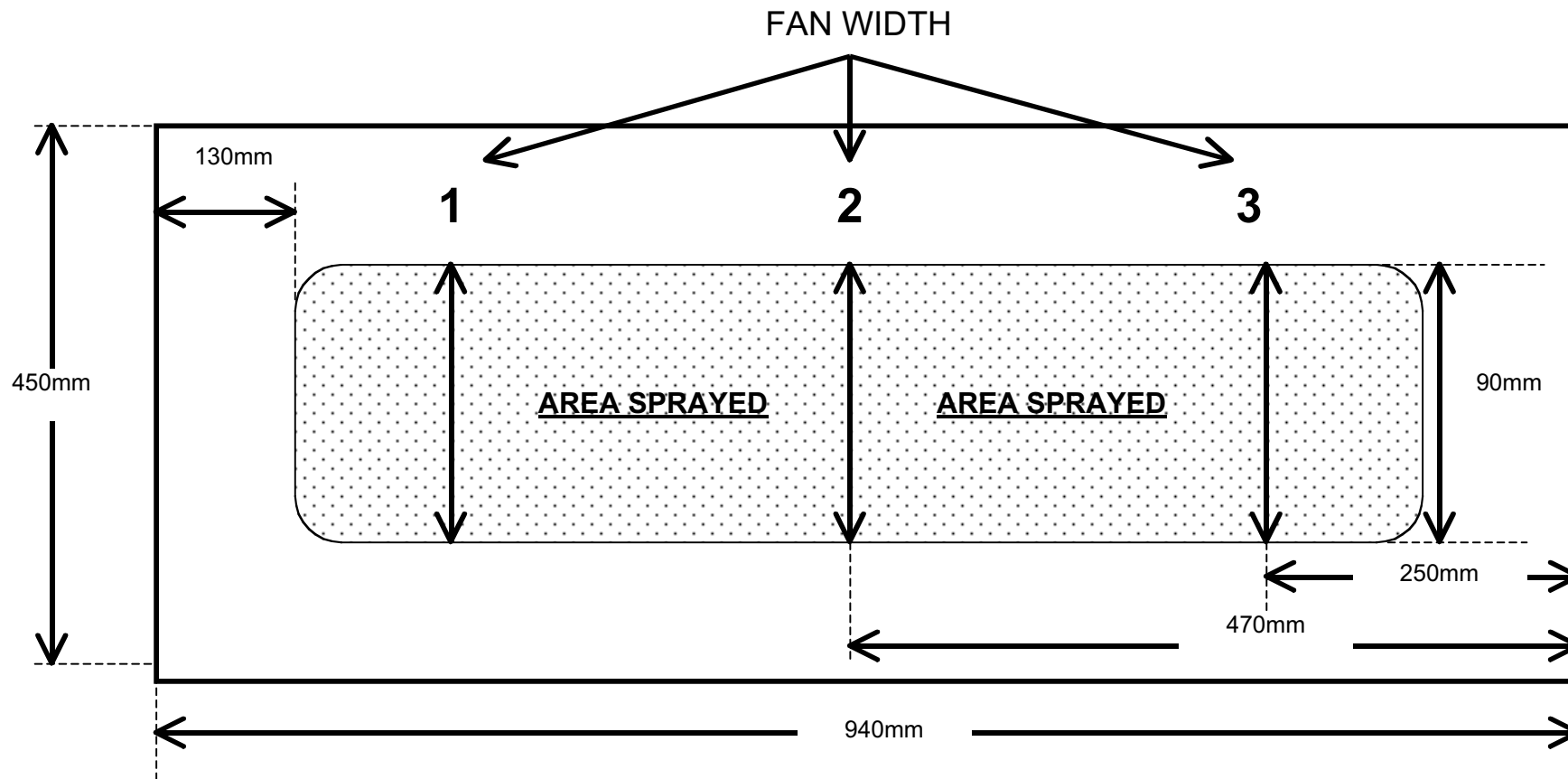
FOIL TEST SAMPLE SIZE, AREA SPRAYED AND  
LOCATION OF FAN WIDTH MEASUREMENTS  
2K HS LACQUER



TE002

APPENDIX A3b Continued

FOIL TEST SAMPLE SIZE, AREA SPRAYED AND  
LOCATION OF FAN WIDTH MEASUREMENT  
WATER BASED BASE COAT



**TE002**

**APPENDIX B1**

**VARIABLES ASSESSED**

**TE003**

AZ10 Suction Gun	Nozzle 1.8mm	–	2KVHS Primer
	Nozzle 1.5mm	–	2K VHS Lacquer Water Based Base Coat

**TE002  
APPENDIX B2**

**MATERIALS USED IN TRANSFER EFFICIENCY TESTS  
AND MIX RATIOS**

**2K PRIMER**

Standex VHS Fuller	02081938	2200064	038
Standex Fuller Harter	02081555	2808679	048
Standex Fuller Thinner	8020541	2020520	026

**Mix Ratio**            372g VHS Fuller  
                             109g Fuller Harter  
                             18g 2K Thinner

**2K LACQUER**

Standex 2K HS Lacquer	02082497	4135431	031
Standex 2K HS Hardener 15-25	02085062	4099913	100

**Mix Ratio**    100g            HS Lacquer  
                     50g                Hardener HS 15-25

**WATER BASED BASE COAT**

Standex Standohyde – Vauxhall Oriental Blue 24L

Mix No            99795-900

Standohyde V.E. Wasser

**Mix Ratio**    1528.1g Base Coat  
                     152g V.E. Wasser

TE002

APPENDIX B3

FAN WIDTH RESULTS GUN DISTANCE 15 cm

		<u>Fan Width</u>				
		<u>Gun</u>	<u>AIR GUNSA A210</u>			<u>Width</u>
			Position (cms)			
<b>Material</b>	<b>Setup</b>	<b>Foil No</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Average</b>
2K VHS Primer	1.8mm 2 Bar	1A	13	13	12	13
		1B	13.5	13.5	13.5	
		1C	13.5	12	13	
		1D	13	12.5	12	
2K HS Lacquer	1.5mm 2 Bar	2A	14.5	14.5	14	13.5
		2B	13.5	13	13.5	
		2C	12.5	13	13	
		2D	14	14	14	
Base Coat	1.5mm 2 Bar	3A	8	8.5	9	9
		3B	9	9.5	9	
		3C	9	8	9	
		3D	10	10	10	

## TE002

### APPENDIX B4

#### MATERIAL SOLIDS

Paint was weighed into a pre-weighed round aluminium foil dish (Approx. 17cm diameter). By tipping the dish the paint was allowed to run and cover the bottom. Stoving was carried out at the temperature and times recommended by the paint manufacturer to cure their paints, as stated in the European Test Method. For stoving conditions of the water based base coat, see the result sheets. Both the foils and solid dishes were stoved together.

After stoving the dishes were allowed to cool and were re-weighed.

Calculations:

1. Aluminium dish weight
2. Wet material weight
3. 'Dry-up' material & dish weight
4. 'Dry-up' weight = (3 – 1)
5. Material solids = (4÷2)

#### Note

All paint was mixed by weight. This was considered a more accurate way of mixing than by volume.

#### VISCOSITY

The viscosity was tested using a DIN 4 Cup

#### PAINT FLUID FLOW THROUGH THE GUN

After setting up the gun it was weighed, the paint sprayed for 15 seconds in the booth and the gun re-weighed. Weight difference gave paint fluid flow for 15 seconds.

# TE002

## APPENDIX B5

### RESULT SHEET

Date: 29.08.01

1. **Materials:** 2KVHS Primer  
**Viscosity:** **Start:** 27s at 25°C **Finish:** 45s at 28°C  
**Spray Temp:** 25°C  
**Spray Humidity:** 42% **Stoving Schedule** **Foil:** }  
**Fan Width Average:** 13cm **Solids Temp/Time** **Foil Tray:** } 60°C for 60 minutes
2. **Material Solids (Tray)**

Panel Dish No	1	2	3	4 (3-1)	5 (4/2)	6
	Aluminium Foil Tray Weight (g)	Wet Material	Dry up Foil Tray Weight (g)	Dry Up (g)	Materials Solid (g)	Average Material Solids (g)
1A	10.505	1.865	12.121	1.616	0.8665	0.8608
1B	10.061	1.948	11.736	1.675	0.8599	
1C	10.018	1.675	11.452	1.434	0.8561	

### 3. Transfer Efficiency (T.E.) on Foil

Foil No	Gun Model	Paint Adj	Pressure at Gun	Spray Distance	Foil Position	No of Gun Passes	Paint Output g/min	1	2	3 (2-1)	4	5 (4x6)	6 (3/5)	T.E. Av %
								Foil Weight	Dry up & Foil	Dry Up	Wet Spray Material	Spray Solid	T.E.	
1A	AZ10	F/O	2 Bar	15cm	Vert	One	212	11.846	20.880	9.034	11.27	9.701	93.1	93.5
1B	AZ10	F/O	2 Bar	15cm	Vert	One	212	11.916	18.729	6.813	8.45	7.274	93.7	
1C	AZ10	F/O	2 Bar	15cm	Vert	One	212	11.903	17.400	5.497	6.85	5.896	93.2	
1D	AZ10	F/O	2 Bar	15cm	Vert	One	212	11.718	17.686	5.968	7.37	6.344	94.1	

F/O = FULLY OPEN

# TE002

## APPENDIX B5 (Cont'd)

### RESULT SHEET

Date: 30.08.01

1. **Materials:** 2K HS Lacquer  
**Viscosity:** **Start:** 21s at 23°C **Finish:** 25s at 24°C  
**Spray Temp:** 22°C  
**Spray Humidity:** 59%  
**Fan Width Average:** 13.5cm
- Stoving Schedule** **Foil:** } 60°C for 30 minutes  
**Solids Temp/Time** **Foil Tray:** }
4. **Material Solids (Tray)**

Panel Dish No	1	2	3	4 (3-1)	5 (4/2)	6
	Aluminium Foil Tray Weight (g)	Wet Material	Dry up Foil Tray Weight (g)	Dry Up (g)	Materials Solid (g)	Average Material Solids (g)
2A	10.486	1.898	11.545	1.059	0.5580	0.5626
2B	10.432	1.921	11.525	1.093	0.5690	
2C	10.386	1.790	11.390	1.004	0.5609	

### 5. Transfer Efficiency (T.E.) on Foil

Foil No	Gun Model	Paint Adj	Pressure at Gun	Spray Distance	Foil Position	No of Gun Passes	Paint Output g/min	1	2	3 (2-1)	4	5 (4x6)	6 (3/5)	T.E. Av %
								Foil Weight	Dry up & Foil	Dry Up	Wet Spray Material	Spray Solid	T.E.	
2A	AZ10	F/O	2 Bar	15cm	Vert	One	124	11.810	14.612	2.802	6.40	3.600	77.8	76.7
2B	AZ10	F/O	2 Bar	15cm	Vert	One	124	11.664	13.716	2.052	4.74	2.667	76.9	
2C	AZ10	F/O	2 Bar	15cm	Vert	One	124	11.793	13.883	2.090	4.87	2.740	76.3	
2D	AZ10	F/O	2 Bar	15cm	Vert	One	124	11.668	13.480	1.812	4.25	2.391	75.8	

F/O = FULLY OPEN



## APPENDIX B5 (Cont'd)

### RESULT SHEET

Date: 30.08.01

1. **Materials:** Water Based Base Coat  
**Viscosity:** Start: 24s at 22°C      **Finish:** 24s at 22°C  
**Spray Temp:** 22°C  
**Spray Humidity:** 59%  
**Fan Width Average:** 9cm
- Stoving Schedule**      **Foil:** } 40°C for 25 minutes (spray cycle)  
**Solids Temp/Time**      **Foil Tray:** } 60°C for 20 minutes (Bake cycle)
6. **Material Solids (Tray)**

Panel Dish No	1	2	3	4 (3-1)	5 (4/2)	6
	Aluminium Foil Tray Weight (g)	Wet Material	Dry up Foil Tray Weight (g)	Dry Up (g)	Materials Solid (g)	Average Material Solids (g)
3A	10.414	1.784	10.729	0.315	0.1766	0.1796
3B	10.376	1.736	10.681	0.314	0.1809	
3C	10.306	2.085	10.684	0.378	0.1813	

### 7. Transfer Efficiency (T.E.) on Foil

Foil No	Gun Model	Paint Adj	Pressure at Gun	Spray Distance	Foil Position	No of Gun Passes	Paint Output g/min	1	2	3 (2-1)	4	5 (4x6)	6 (3/5)	T.E. Av %
								Foil Weight	Dry up & Foil	Dry Up	Wet Spray Material	Spray Solid	T.E.	
3A	AZ10	F/O	2 Bar	15cm	Vert	One	139	11.743	12.499	0.756	5.29	0.950	79.6	79.7
3B	AZ10	F/O	2 Bar	15cm	Vert	One	139	11.763	12.532	0.769	5.35	0.961	80.8	
3C	AZ10	F/O	2 Bar	15cm	Vert	One	139	11.698	12.419	0.721	5.09	0.914	78.9	
3D	AZ10	F/O	2 Bar	15cm	Vert	One	139	11.765	12.535	0.770	5.35	0.961	80.1	

F/O = FULLY OPEN

## **APPENDIX B6**

### **INVESTIGATION INTO “SOLIDS” DETERMINATION**

#### **REF. ISO3251**

Ref: stoving / drying schedules for paint solids determination (clause 6.2.2.3) and for the sprayed foils (Clause 6.8) in the test method EN 139661-1 for transfer efficiency (T.E) .

#### **Introduction**

The previous draft for T.E. of 16 Jan 2000 allowed various stoving / drying schedules for paint solids determination. This resulted in a variation of T.E. results depending on which paint solids schedule was chosen, as the stoving / drying schedule determined the actual paint solids figure obtained.

In order to rectify this anomaly the amended test method of July 04, 2001 defines the stoving / drying of both the paint solids determination and the sprayed foils to be the same and to the stoving / drying schedule specified by the paint manufactures. This now gives a disparity in the degree of paint “dryness” between the paint solids determination and the sprayed foils. This was evident during the testing of T.E., where paint solids dishes still lost weight after stoving / drying to manufacturers schedule whereas the sprayed foils did not loose any significant weight.

#### **Results and discussions**

ISO 3251 uses a 7.5cm dia. dish and one gram of paint. If we assess the paint thickness (i.e. weight of wet paint / sq. cm.) for solids determination compared to the weight of wet paint / sq. cm. on the sprayed foils using a 2K HS lacquer, then:

##### **ISP 3251**

Dish size dia 7.5cm Area of dish bottom = 44 sq. cm.

1 gm of paint used.

Therefore, 1gm wet paint covers 44 sq.cm

##### **Sprayed Foils**

Approx. area sprayed 20cm x 70cm = 1400 sq.cm.

Approx. 8-12 gms paint sprayed at say 75% T.E.

Therefore 6-9 gms (mean value 7.5gms) of wet paint covers 1400sq.cm

1 gm . wet paint covers 190 sq. cm.

To ensure the same thickness of wet paint in both situations, the amount of the wet paint used in the paint solids determination should be  $1/190 \times 44 = 0.2\text{gm}$ .

ISO 3251 does allow test portions other the 1gm to be used under agreement between parties.

The variations of T.E with 2K HS Lacquer using recommended stoving / drying schedule by the paint manufacturer of 60°C for 30 minutes, and various paint weights for solids determination gave:

1gm used in solids determination. Solids 66% T.E. 65%  
0.2gm used in solids determination. Solids 59% T.E. 72%

Because of the small quantities of paint now suggested 0.001gm accuracy of the weighing scales, may be required.

Using larger dishes for paint solids determination allows for larger quantities of paint to be used, and possibly the same scales to be used for all weighing.

Large aluminium dishes are obtainable at 17cm dia.  
Area of dish bottom = 227sq.cm

To achieve equivalent wet paint/sq.cm. as on the sprayed foils 227/190 gms of paint could be used i.e 1.2gm.

Tests have shown using either 0.15 –0.2gm of paint in the smaller dish or 1.4-1.6gm in the large dish gave equivalent paint solids result at 60° c for 30 minutes using 2K HS Lacquer.

#### Note

Sartorius manufacture scales that weigh to 0.001gm up to 1kg, and then weight to 0.01gm above. Model No LP3200D. These scales would cover all weighing if the larger solids dishes were used.

## **Conclusion**

1. The weight of paint used in the paint solids method, as specified in EN ISO 3251, may require amending to give an equivalent paint “dryness” to the sprayed paint on the foils, which is the conditions required for T.E., especially if the paint manufactures stoving schedule is used.
2. In order to obtain similar “dryness” of paint in both situations the following is suggested for solids determination:
  - Dish size 7.5cm dia. – Paint weight 0.15 +/- 0.01gm.
  - Dish size 17cm dia. – Paint weight 1.3 +/- 0.1gm.

Conclusions 1& 2 are especially relevant for 2K primers, 2K direct gloss and 2K HS Lacquer where the stoving / curing schedules are 20-30 minutes at 60 –70°C.

In order to ensure both the paint solids determination and the sprayed foils are stoved to the same schedule, as now required, they should be stoved together.