

STADCO Coventry

Determination of Particulates
Sealer Coat (ED) Plant
Holbrook Lane, Coventry
CV6 4AW

12 January 2006

Prepared by: CES Environmental Instruments Ltd
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Report prepared by

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Executive Summary

Operator Company: - Mayflower Vehicles Systems

Address: - Holbrook Lane, Coventry, CV6 4AW

Monitoring Company: - CES Environmental Instruments Ltd

Address: - Bretby Business Park, Ashby Road, Stanhope, Bretby
Burton on Trent, DE15 0YZ

Analytical Company: - CES Environmental Instruments Ltd

Address: - Bretby Business Park, Ashby Road, Stanhope, Bretby
Burton on Trent, DE15 0YZ

Monitoring Objective

To monitor and quantify particulate emissions to atmosphere from the Sealer Coat (ED) Plant located at Mayflower Vehicle Systems, Holbrook Lane, Coventry

Test Team

R. Ward (Team Leader), K. Warchol

Deviations from Sampling Method

None

Results

Date of Sampling: 12 January 2006

Location	Pollutant	Test No.	Concentration mg/Nm ³	Mean Concentration mg/Nm ³	Emission Rate kg/hr	Mean Emission Rate kg/hr
Sealer Coat (ED) Plant	Particulate	1	1.3	0.7	0.056	0.028
Sealer Coat (ED) Plant	Particulate	2	0.0		0.000	
Sealer Coat (ED) Plant	Particulate	Blank	0.0	0.0		

Results Correct to

Temperature		Pressure		Oxygen		Gas	
°C/K	0/273	mbar/kPa	1013/101.3	%		Wet/Dry	Wet

1. Introduction

STADCO Coventry placed an order with CES Environmental Instruments Ltd, to monitor and quantify particulate emissions to atmosphere from the Sealer Coat (ED) Plant located at STADCO Coventry, Holbrook Lane, Coventry. Test work was carried out 12 January 2006, and was undertaken by R. Ward (Team Leader), K. Warchol.

2. Plant Details

2.1 Sealer Coat Plant

The Seal Coat Plant is a wetback filter system with a single fan and stack. This is used for compliant coatings only.

3. Materials Used

Sealercoat Particulates Monitoring 12/01/06			
Materials Used During Monitoring Exercise			
Manufacturer	Parts Sprayed	Description	Type/ identity number
Hemmelwrath	Taxis & Parts 7.00 TO 12.30	Hydro-Primer Surfacer 3902	Mid Grey 31.03902.0
PPG	Taxis & Parts 12.30 TO 16.30	1-963G182X-HG	Mid Grey 1-963G182X-HG
Notes	Parts Sprayed Spraying commenced at	13 Off Taxis & 12 Sets of Parts (Bonnet, wings etc.) Shift started at 7.00am and finished at 16.30 30 minute lunch break between 12.30 to 1.0	NOTE: Change of paint supplier from Hemmelwrath to PPG mid way through shift

4. Sampling Location

4.1 Sealer Coat

Sampling was undertaken in the vertical duct, the duct was measured to be 1400mm x 1100mm giving a cross sectional area of 1.54m². There are two 4" BSP sockets. Samples were taken from 4 points on each axis, 8 in total.

The sample location does not comply with BS EN 13284-1 for the following reasons:

1. The sample plane does not comply with the minimum requirement in length upstream and downstream.

5. Test Programme

Two particulate emissions tests were carried out on each stack. Particulate emission measurements were made using the Erwin Sick “Gravimat SHC5” isokinetic dust sampling system. The method complies with the requirements of BS EN 13284-1 (Determination of low range mass concentration of dust). A detailed description of this method is given in Appendix 2.

Sampling equipment reference C120 – Gravimat SHC-5

6. Plant Emissions

All results are corrected to 0°C (273K) and 1013mbar (101.3 kPa)

7. Results

Date of Sampling: 12 January 2006

Location	Pollutant	Test No.	Concentration mg/Nm ³	Mean Concentration mg/Nm ³	Emission Rate kg/hr	Mean Emission Rate kg/hr
Sealer Coat (ED) Plant	Particulate	1	1.3	0.7	0.056	0.028
Sealer Coat (ED) Plant	Particulate	2	0.0		0.000	
Sealer Coat (ED) Plant	Particulate	Blank	0.0	0.0		

Results Correct to

Temperature		Pressure		Oxygen		Gas	
°C/K	0/273	mbar/kPa	1013/101.3	%		Wet/Dry	Wet

8. Appendix 1
(Extraction Protocol)

Site : STADCO, Coventry
 Date : 12 January 2006
 Plant : Sealercoat Plant
 File Ref. 4021

Mean Particulate Results

Filter	mg/m ³	kg/hr
80338	1.3	0.056
80134	0.0	0.000
Mean	0.7	0.028

Control Blank Filter

Filter	Volume (m ³)	
80338	0.951	
80134	0.973	
Mean	0.962	(Reference Conditions with no correction for Oxygen)

Filter 10404

Tare Weight 17889.5 mg
 Gross Weight 17889.5 mg

Gain 0.0 mg

Measured Oxygen 0.0 %

Concentration 0.0 mg/Nm³

Results Correct to

Temperature		Pressure		Oxygen		Gas	
°C/K	0/273	mbar/kPa	1013/101.3	%		Wet/Dry	Wet

dust concentration measurement
protocol of velocity / temperature measurement

ERWIN SICK Optic Electronic

file : 4021SCT1.SMP

12.01.06
10:52-11:32

plant : Sealercoat plant
measuring place: Stadco
engineer : RW/KW

remarks :
Normal Operations
Dim.=1400x1100mm

constants and parameters :

dyn.pressure	[mbar]	: 1086
normal density	[kg/m3]	: 1.288
water vapour	[%Vol]	: 0.00
cross section of the duct	[m2]	: 1.54

results

density	[kg/m3]	: 1.216
volume flow act.	[m3/h]	: 46492
volume flow norm wet	[m3/h]	: 43883
volume flow norm dry	[m3/h]	: 43883

dust concentration measurement
 protocol of velocity / temperature measurement

ERWIN SICK Optic Electronic

file : 4021SCT1.SMP

dust probe : 80338

12.01.06
 10:52-11:32

measured values and calculations

axis	depth	p_duct [mbar]	p_dyn [mbar]	T [°C]	v_duct [m/s]	angle [°]
1	1	0.0	0.44	16.2	8.5	0.3
1	2	0.0	0.41	16.3	8.2	-3.0
1	3	0.0	0.36	16.5	7.6	1.0
1	4	0.0	0.36	16.5	7.6	1.6
1	5	0.0	0.37	16.5	7.8	0.6
1	6	0.0	0.39	16.4	8.0	2.0
1	7	0.0	0.44	16.4	8.5	-0.2
1	8	-0.4	0.51	16.4	9.2	1.4
1	9	-0.4	0.54	16.4	9.5	-2.1
1	10	-0.4	0.50	16.4	9.1	-3.0
2	1	0.0	0.44	16.4	8.5	-2.0
2	2	0.0	0.42	16.4	8.3	-1.0
2	3	0.0	0.37	16.4	7.8	0.0
2	4	0.0	0.36	16.4	7.6	0.3
2	5	0.0	0.36	16.4	7.7	-1.1
2	6	0.0	0.38	16.4	7.8	3.1
2	7	0.0	0.44	16.4	8.5	1.8
2	8	-0.3	0.51	16.5	9.2	-2.8
2	9	-0.4	0.53	16.5	9.3	-1.8
2	10	-0.4	0.51	16.5	9.1	3.2
mean :		-0.1		16.4	8.4	

dust concentration measurement
protocol of isokinetic extraction measurement

ERWIN SICK Optic Electronic

file : 4021SCT1.SMP dust probe : 80338

12.01.06
10:52-11:32

plant : Sealercoat plant
measuring place: Stadco
engineer : RW/KW

remarks :
Normal Operations
Dim.=1400x1100mm

constants and parameters :

dyn.pressure	[mbar]	: 1086
normal density	[kg/m3]	: 1.288
water vapour	[%Vol]	: 0.00
cross section of the duct	[m2]	: 1.54
diameter of nozzle	[mm]	: 8.0
extraction/point	[h:m:s]	: 00:05:00
tare weight of probe	[mg]	: 17262.0
gross weight of probe	[mg]	: 17263.2

results

volume flow	[m3/h]	: 1.514
extracted vol. act.	[m3]	: 1.010
extracted vol. norm. hum.	[m3]	: 0.951
extracted vol. norm. dry	[m3]	: 0.951
volume flow act.	[m3/h]	: 46885.5
volume flow norm wet	[m3/h]	: 44151.4
volume flow norm dry	[m3/h]	: 44151.4
total extraction time	[h:m:s]	: 00:40:00
dust weight	[mg]	: 1.2
dust conc. act.	[mg/m3]	: 1.2
dust conc. norm. wet	[mg/m3]	: 1.3
dust conc. norm dry	[mg/m3]	: 1.3
particulate flow rate	[kg/h]	: 0.056
extinction	[mA]	: 0.00

dust concentration measurement
 protocol of isokinetic extraction measurement

ERWIN SICK Optic Electronic

file : 4021SCT1.SMP

dust probe : 80338

12.01.06
 10:52-11:32

a	d	p_duct [mbar]	p_dyn [mbar]	T [°C]	v_duct [m/s]	p_orif [mbar]	p_prob [mbar]	I_cal [mA]	q [m3/h]	angle [°]
1	1	0.0	0.41	16.7	8.2	5.30	-15	0.00	1.45	0.5
1	2	0.0	0.38	16.8	7.9	5.02	-15	0.00	1.42	1.8
1	3	0.0	0.44	16.9	8.5	5.70	-15	0.00	1.51	4.0
1	4	-0.5	0.55	17.1	9.5	7.41	-17	0.00	1.72	4.6
2	1	0.0	0.40	17.2	8.1	5.10	-13	0.00	1.43	-2.6
2	2	0.0	0.38	17.2	7.8	4.85	-13	0.00	1.40	1.7
2	3	0.0	0.43	17.3	8.4	5.65	-13	0.00	1.50	2.0
2	4	-0.5	0.52	17.4	9.3	7.09	-15	0.00	1.68	-0.4
mean :		-0.1		17.1	8.5			0.00	1.51	

dust concentration measurement
protocol of isokinetic extraction measurement

ERWIN SICK Optic Electronic

file : 4021SCT2.SMP dust probe : 80134

12.01.06
13:00-13:41

plant : Sealercoat plant
measuring place: Stadco
engineer : RW/KW

remarks :
Normal Operations
Dim.=1400x1100mm

constants and parameters :

dyn.pressure [mbar] : 1103
normal density [kg/m3] : 1.288
water vapour [%Vol] : 0.00
cross section of the duct [m2] : 1.54
diameter of nozzle [mm] : 8.0
extraction/point [h:m:s] : 00:05:00
tare weight of probe [mg] : 18598.6
gross weight of probe [mg] : 18598.6

results

volume flow [m3/h] : 1.451
extracted vol. act. [m3] : 0.968
extracted vol. norm. hum. [m3] : 0.973
extracted vol. norm. dry [m3] : 0.973

volume flow act. [m3/h] : 45092.5
volume flow norm wet [m3/h] : 45343.7
volume flow norm dry [m3/h] : 45343.7

total extraction time [h:m:s] : 00:40:00
dust weight [mg] : 0.0

dust conc. act. [mg/m3] : 0.0
dust conc. norm. wet [mg/m3] : 0.0
dust conc. norm dry [mg/m3] : 0.0

particulate flow rate [kg/h] : 0.000
extinction [mA] : 0.00

dust concentration measurement
 protocol of isokinetic extraction measurement

ERWIN SICK Optic Electronic

file : 4021SCT2.SMP

dust probe : 80134

12.01.06
 13:00-13:41

a	d	p_duct [mbar]	p_dyn [mbar]	T [°C]	v_duct [m/s]	p_orif [mbar]	p_prob [mbar]	I_cal [mA]	q [m3/h]	angle [°]
1	1	0.0	0.40	17.7	7.9	5.11	-10	0.00	1.39	0.7
1	2	0.0	0.36	17.9	7.4	4.55	-9	0.00	1.31	0.4
1	3	0.0	0.42	18.0	8.0	5.49	-11	0.00	1.44	-0.3
1	4	-0.6	0.56	17.9	9.3	7.48	-13	0.00	1.67	-1.1
2	1	0.0	0.39	17.8	7.8	4.98	-9	0.00	1.37	-0.8
2	2	0.0	0.36	17.8	7.4	4.48	-8	0.00	1.30	-5.0
2	3	-0.4	0.44	17.9	8.2	5.68	-10	0.00	1.46	3.6
2	4	-0.6	0.55	18.1	9.2	7.38	-12	0.00	1.67	-0.9
mean :		-0.2		17.9	8.1			0.00	1.45	

**9. Appendix 2
(Sampling Methods)**

Erwin Sick Sampling Train

Extractive dust measurements were made using the Erwin Sick “Gravimat SHC-5” isokinetic dust sampling system. The equipment uses a stainless steel probe which combines a sampling nozzle and filter, 3 pitot pressure inlets and a thermocouple. Real time velocity, turbidity and temperature measurements are provided for the control processor to modulate the pump speed and continuously ensure isokinetic conditions are maintained.

The Gravimat SHC-5 portable dust concentration measuring system operates on the gravimetric measuring principle as required by BS 3405 and BS 6069. The dust-laden gas is isokinetically extracted by a scavenging probe. A special filter retains the dust. The dust content is determined by differential weighing of the dust collectors together with the filters. This avoids the dust losses which are inevitable when the filters are removed. The dust concentration in mg/m^3 can then be calculated from the relationship between the dust weight and the volume of gas extracted.

The Gravimat SHC-5 gravimetric dust concentration measuring system comprises the following components:

- * GS 5 filter head probe with accessories
- * SHC-AE control unit
- * Evaluation computer (laptop) with SMP5 measuring and evaluation software
- * SHC-PS power supply unit
- * SHC-TU transport unit, optional.

The SHC-AE control unit performs the isokinetic control that is necessary for precise measurements. It is connected to the multi-chamber hose and the thermocouple of the GS 5 probe as well as to the evaluation computer. All the measured data is automatically collected and recorded together with the extraction measurements time, relieving the operator of control and recording duties during the monitoring process. The operator is simply required to move the probe to the next measurement point at a signal from the control unit.

Before testing all recommended system checks and leak tests were carried out. The filters were assembled and then dried in an oven at 180°C , cooled in a desiccator and then weighed on a 0.1mg resolution balance. After testing the filters were weighed in a similar fashion with the oven set at a temperature of 160°C .

Features:

- * Considerably improved measuring accuracy through the newly developed GS 5 filter head probe.
- * The probe can be used for both high (several g/m^3) and very low dust concentrations (less than $1\text{ mg}/\text{m}^3$)
- * Fully automatic detection and storage of all relevant measured values during extraction of the sample.
- * Fully automatic isokinetic control precludes operator error and increases the accuracy of the measurement.
- * Automatic logging of all measurements - only the weight of the dust collector and plant-specific comments have to be entered manually.

10. Appendix 3
(Calibration Certificates)

Certificate of Calibration

Date of Issue: 27 June 2005

CES Environmental Instruments Ltd
Bretby Business Park, Ashby Road
Burton-on-Trent, Staffordshire, DE15 0YZ
Tel: 01283 216334 Fax: 01283 550939

Certificate No. 

Certified By

Instrument Details

Instrument Type	Gravimat SHC-5
Instrument Make	Erwin Sick
Instrument Serial No.	93055129
Quality No.	C120
Calibration Date	20/06/2005
Calibrated By Name	R. Allen

Ambient Conditions

Air Temperature (°C)	25	--
Barometric Pressure (mbar)	1008	--
Relative Humidity (%)	57	--

Instruments used to undertake calibration

E Type Pitot	UKAS Certificate No. N8731/05	(Qu. No. C136)
Manometer Type FC012	UKAS Certificate No. 01799	(Qu. No. C082)
Manometer Type FC012	UKAS Certificate No. 01798	(Qu. No. C081)
Barometer Type 104	UKAS Certificate No. N1136252V	(Qu. No. C138)
Gallus Dry Gas Meter	UKAS Certificate No. N2054787F	(Qu. No. C125)
RIS Supersal XT	UKAS Certificate No. N2054798E	(Qu. No. C014)

* Not UKAS traceable

** Indication only

Flow and Extraction

The reference pitot was placed in a wind tunnel located at Bretby Business Park. The Gravimat SHC-5 Sampling Probe under test was mounted within the same wind tunnel in close proximity to the reference pitot. The wind tunnel was operated to generate a differential pressure across each pitot, a direct comparison was made. The differential pressures measured were in the region of the calibration points of the reference pitot. Correction factors were applied to the reference pitot and compared to the differential pressure shown for the pitot under test. The extraction system of the unit was operated for a period of one minute.

Volume Flow

A calibrated dry gas meter was connected to the sampling nozzle of the Gravimat SCH-5. A volume of air is pulled through the sampling system. The measured value shown on the calibrated dry gas meter is then compared to the indicated value on the Gravimat SCH-5 display.

Barometric Pressure

The barometric pressure was measured using a calibrated barometer. The indicated pressure was compared to the Gravimat SHC-5 display.

Temperature

The probe thermocouple was placed in a thermocouple oven and heated. The temperature was measured using a calibrated thermocouple and temperature indicator. The resultant temperature was compared to the Gravimat SCH-5 display.

Current

A mA current source was injected into the Gravimat SCH-5 using a mA current generator. The injected current was compared to the Gravimat SCH-5 display.

Certificate of Calibration

Date of Issue: 27 June 2005

CES Environmental Instruments Ltd
 Bretby Business Park, Ashby Road
 Burton-on-Trent, Staffordshire, DE15 0YZ
 Tel: 01283 216334 Fax: 01283 550939



Certified By

Instrument Details

Instrument Type Gravimat SHC-5
 Instrument Make Erwin Sick
 Instrument Serial No. 93055129
 Quality No. C120
 Calibration Date 20/06/05

Ambient Conditions

Air Temperature (°C) 25 **
 Barometric Pressure (mbar) 1008
 Relative Humidity (%) 57 **
 Air Density @ 0°C (kg/m³) 1.2770
 Corrected Air Density (kg/m³) 1.1641

Calibration Details

Flow and Extraction

Applied Pressure (Pa)	Pitot Correction	Applied Pressure Corrected (Pa)	SHC5 p-dyn (Pa)	Pressure Factor	Calculated Velocity (m/s)	SHC5 Velocity (m/s)	Velocity Factor	Nozzel Diameter (mm)	Calculated Extraction (m³/hr)	SHC5 Extraction (m³/hr)	Extraction Factor
3.5	0.985	3.4	3.5	0.99	2.434	2.358	1.03	10.0	0.69	0.68	1.01
44.6	0.998	44.5	44.0	1.01	8.745	8.912	0.98	8.0	1.58	1.54	1.03
96.4	1.000	96.4	95.8	1.01	12.869	12.684	1.01	6.4	1.49	1.46	1.02
168.2	1.001	168.4	166.2	1.01	17.008	17.403	0.98	6.4	1.97	1.93	1.02
210.9	0.999	210.7	205.8	1.02	19.026	19.541	0.97	6.4	2.20	2.24	0.98
Mean (excluding 3.5Pa)				1.01			0.99				1.01

Volume Flow

Nominal Flow Rate l/min	Actual Flow Rate l/min	Actual Flow Rate m³/hr	Orifice Constant
15.00	14.883	0.893	14.08
20.00	20.100	1.206	14.34
25.00	25.050	1.503	14.33
30.00	29.817	1.789	14.33
Instrument Orifice Constant (@1.5m³/hr) =			14.33

Barometric Pressure

Pressure	
Required Value (mbar)	Indicated Value (mbar)
1010.0	1010.0
1008.0	1008.0
1004.0	1004.0

Temperature

Temperature Input	
Required Value (°C)	Indicated Value (°C)
25.0	25.0
50.0	50.0
100.0	99.6
150.0	148.9
250.0	249.1
300.0	299.0

Current

Current Value	
Required Value (mA)	Indicated Value (mA)
0.0	0.0
5.0	5.0
10.0	10.0
15.0	15.0
20.0	20.0

Time

Time Period mins	Required Value mins	Within Limit
3:00	2:59 → 3:01	Yes
5:00	4:59 → 5:01	Yes
10:00	9:59 → 10:01	Yes