

Report of Environmental Monitoring carried out at: -


Burbidge & Son Ltd
Awson Street
Foleshill
Coventry CV6 6GJ

For the attention of Mr J Gwilliam

Examination, Assessment and Report by: -

Mike Thomas
24 St James Road
Little Paxton
St Neots
PE19 6QW

tel 01480 387749

Authenticating Signature ... 

Date: - January 2006

Contents

Introduction

Reference documents

Sampling protocols

Equipment used

Location and identification of sampling points

Deviation from standards

Results

Conclusions

Appendix 1- sampling protocols

Appendix 2- equipment used

Appendix 3- location and identification of sampling points

Appendix 4- results

Introduction

This report relates to a visit to the premises of Burbidge & Son Ltd. at Awson Street in Coventry on 23rd January 2006 and subsequent dates to complete measurements. The purpose of this visit was to carry out emissions monitoring as part of compliance with The Pollution Prevention and Control (England and Wales) Regulations 2000. The process is authorised by City of Coventry, permit number PPC/045.

The emission points were monitored for particulate matter as appropriate.

The process conditions at the time of monitoring were typical operating conditions unless noted.

Reference documents

The reference documents used for the emissions monitoring were

- PG6/33 Secretary of State's Guidance- Wood Coating Processes
- EN 13284-1:2001, tangential method

Sampling protocols

The following protocols were used in the emissions monitoring

- Stack sampling protocol- Measurement of airflow
- Stack sampling protocol- Measurement of particulate matter

These protocols are included in this report in Appendix 1.

Equipment used

The following equipment was used in the emissions monitoring

- DP-CALC micromanometer and pitot tube
- SKC Highlite high volume sampling pump and rotameter
- In-stack particulate filter head using 4mm nozzle unless specified

Information on the equipment and appropriate calibration details are included in this report in Appendix 2.

Location and identification of sampling points

The location and identification of the sampling points are shown diagrammatically in Appendix 3 of this report.

Deviations from standards

1. Due to the variable work patterns at the spraying positions and the need to run extended sampling times it was not always possible to sample the same coating process each time in each stack. This can potentially lead to a larger variation between measurements than might be expected.
2. The air flow in the stacks was generally turbulent and did not follow the normal velocity gradient across the diameter of the stack. In order to minimise error in the measurement of particulate emissions additional air velocity measurements were taken where necessary at the 0.15D and 0.85D particulate sampling points and used to determine the isokinetic sampling rate.

3. The occupancy of some spray booths was generally low with a small quantity of material being sprayed. It was therefore not always possible to take the requisite number of samples. In some instances specific spraying operations have been targeted to give an indication of potential worst case situations.
4. Sampling ports
The sampling ports in the manual spray booths, in particular spray booths 3 and 4, have been sited closer to the extraction fans than normally recommended for representative sampling.

Results

A summary of results is given in the following table. The results in detail are given in Appendix 4.

It is difficult to estimate the accuracy of the results given the variability of the process and plant. Probable significant errors in the measurement of particulate matter are from air turbulence (10%) and low weight sample weighing (10%).

Stack Position	Particulate emissions average mg/m ³
Spraybooth 1- left	1.3
Spraybooth 1- right	0.8
Spraybooth 2- left	0.6
Spraybooth 2- right	1.5
Spraybooth 3	-
Spraybooth 4	1.5
Stain Cab 1	9.2
Lacquer Cab 2	1.3

Conclusions and Discussion

The particulate emissions were lower than normal for the manual spray booths due to the nature of the work undertaken and to the effective maintenance programme. Typical emissions for the furniture industry are 0-10 mg/m³ for normal conditions and 10-15 mg/m³ for high use or poor filter condition.

The occupancy of some spray booths was relatively low reflecting the reduced workload for these positions. The particulate measurements were taken when these positions were in use.

Appendix 1- Sampling Protocols

SAMPLING PROTOCOL 1

Stack Sampling Protocol- Measurement of airflow

1. Instrumentation

The preferred instrument for measuring airflow in stacks is the pitot tube. This is a differential pressure probe designed to cause minimal turbulence when inserted into the airflow. The total pressure within the stack comprises of Velocity pressure, caused by the movement of the air, and Static pressure, exerted in all directions by compression or expansion of the air caused by the process e.g. extraction fan. The BS 1042 pitot tube has an ellipsoidal tip that is aligned into the direction of flow. The pitot tube has two separate tappings. The tip is affected by total pressure in the stack whereas the tappings perpendicular to the tip are affected by the static pressure only. The velocity pressure is the difference between the two.

The pressures exerted on the pitot tube are measured by an electronic micromanometer. This provides the static and velocity pressures and the air velocity in the stack.

The micromanometer can be set to display true velocity readings by automatically correcting for actual test point gas density using independently measured test temperature and barometric pressure.

2. Measuring site location

Wherever possible the sampling port should be located in a region with sufficiently high and homogeneous gas flow. As a guideline the minimum distances, in terms of stack diameters, from points of turbulence should be as follows; fan (3), junction (2) and bend (1). The location should be at least one diameter upstream of the next point of turbulence. In practice the greater the distances, the more reliable the airflow. In some cases these conditions cannot be met and measurements in these situations must be taken with some caution and do not comply with the standard.

3. Measurements

Measurements are taken at a series of points across the ducts. The positions of the points, along with alternative strategies, are given in EN 13284-1:2001. In situations where the airflow is not linear, preference is given to measuring air velocity at the points where sampling will occur.

SAMPLING PROTOCOL 2

Stack Sampling Protocol- Measurement of particulate matter

1. Air velocity in stack

Measure the airflow in the stack using pitot tube, micromanometer, barometer and thermometer.

The micromanometer can be set to display true velocity readings by automatically correcting for actual test point gas density using independently measured test temperature and barometric pressure.

2. Isokinetic sampling for particulate matter

In isokinetic sampling the velocity of flow into the sampling head is matched to the airflow velocity in the stack. This ensures an even flow of lighter particles into the head. If the sampling flow is set too low the light particles tend to be carried around the head by the airflow. If set too high, the light particles are pulled into the head from outside sampled volume of air. The required sampling rates can be determined by calculation or from standard tables.

3. Sampling

Particulate sampling is taken over a 120-210 minute period at points specified in EN 13284-1:2001, tangential method. The samples are collected onto a pre-weighed glass fibre filters in an assembly inside the stack. The filters are reweighed to determine the quantity of particulate matter collected. Dummy filters are used for internal calibration.

4. Presentation of results

Particulate sampling is assessed by weight (gravimetrically). The weight is normally expressed in milligrams.

The volume of air sampled is derived from the sampling flow rate and the sampling time. The volume is expressed in cubic metres. Measurements are taken without correction for water vapour content.

The concentration of particulate matter is expressed as milligrams per cubic metre or mg.m^{-3} .

Appendix 2- Equipment Used

Model 8704

The advanced Model 8704 DP-CALC has all of the features of the Model 8702 and more.

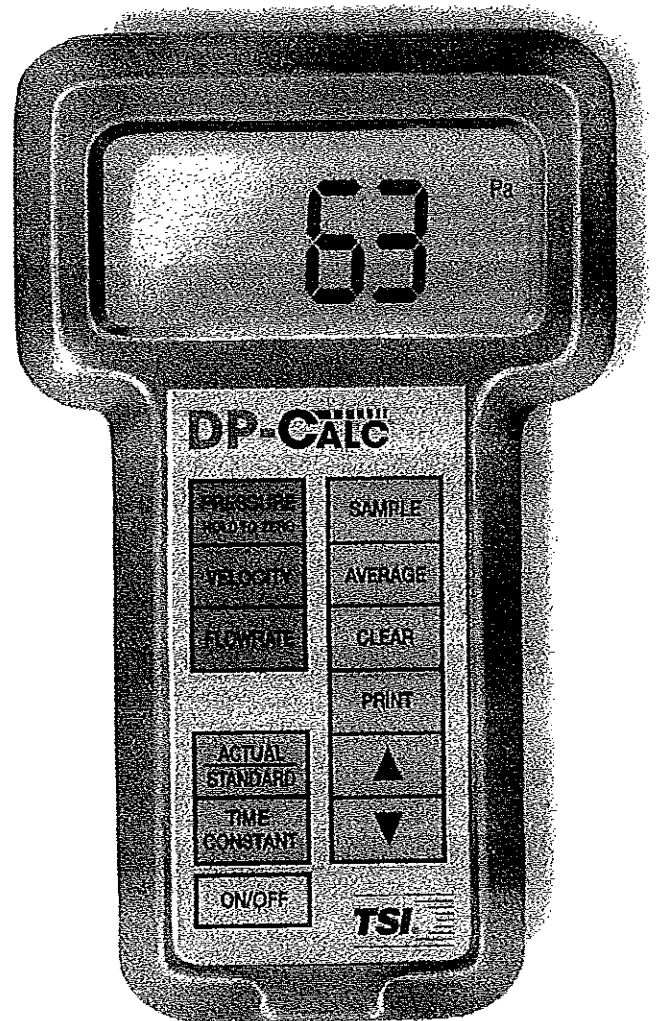
The Model 8704 allows storing of up to 500 data points, calculates volumetric flowrate along with velocity, converts between actual and standard velocity, and calculates statistics such as average, minimum, maximum and count. The saved data can then be recalled or downloaded to a computer for further analysis.

Volumetric flowrate calculations also include a K factor. The included software allows downloading of the data into a spreadsheet. These features save you time in taking measurements and reporting results.

Features	8702	8704
Differential Pressure	●	●
Static Pressure	●	●
Velocity	●	●
Volumetric Flowrate		●
Calculates min/max		●
Variable Time Constant	●	●
Density Correction		●
Calculate Average	●	●
K Factor		●
Data Logging		●
Data Reporting Software*		●
Printer Output	●	●
NIST** Calibration Certificate	●	●

*Requires use of a spreadsheet software package

**U.S. National Institute of Standards and Technology



Model 8704

Backed by TSI Expertise

TSI Incorporated has more than 30 years experience in air flow measurement technology. It's this type of experience and innovation that provides you with accurate and reliable instruments. Along with TSI's expertise, each instrument is backed by a two year limited warranty and the industry's best service policy. Not only is service performed quickly, but calibrations are NIST traceable and a free certificate of calibration is included.

Models 8702 and 8704 DP-CALC Micromanometers Specifications

Pressure:
Range: -1245 to 3735 Pa (-9.3 to 28.0 mm Hg, -5 to +15 in. H₂O)
Accuracy: ±1% of reading ±1 Pa (±0.01 mm Hg, ±0.005 in. H₂O)
Resolution: 1 Pa, 0.01 mmHg (0.001 in. H₂O)

Velocity:
Range: 1.25 m/s to 78.5 m/s (250 ft/min - 15,500 ft/min)
Accuracy: ±1.5% at 10 m/s (2,000 ft/min)

Instrument Temperature Range:
Operating range: 0 to 70°C (32 to 158°F)
Storage range: -40 to 85°C (-40 to 185°F)

Averaging Capability: (Model 8702 only)
Range: Up to 255 values each of pressure and velocity

Flow Rate: (Model 8704 only)
Displayed range: 1 to 9,999,000 ft³/min, m³/h, l/s
Factor range: 0.01 to 2
Flow factor range: 0.01 to 999.9

Storage Capability: (Model 8704 only)
Range: Up to 500 values

Time Constant:
Values: 1, 5, 10, 15, or 20 seconds

Power Requirements:
Batteries: Four AA-size Alkaline or NiCd rechargeable
Approx. battery life: 24 hours (Alkaline), 7 hours (NiCd)
AC adapter (optional): 7 VDC nominal, 300 mA

Physical:
External dimensions: 100 mm x 168 mm x 38 mm
(3.9 in. x 6.6 in. x 1.5 in.)
Weight (with batteries): 0.35 kg (0.76 lb.)
Display: 4-digit LCD, 15 mm (0.6 in.) digit height

Printer Interface:
Type: Serial
Baud rate: 1200

Recommended Maintenance Schedule:
Factory calibration: Annually

8702 DP-CALC includes the following accessories:
1 - carrying case 1 - NIST certificate of calibration
4 - size AA batteries 1 - operation and service manual

8704 DP-CALC includes the following accessories:
1 - carrying case 1 - NIST certificate of calibration
1 - static tube 1 - operation and service manual
4 - size AA batteries 1 - downloading software disk
2.44 m of tubing

1 Pressure velocity measurements are not recommended below 5.08 m/s and are best suited to velocities over 10.16 m/s.

2 Accuracy is a function of converting pressure to velocity. Conversion accuracy improves when actual pressure values increase.

3 Actual range is a function of maximum velocity, pressure, duct size, K factor and density correction.

Specifications are subject to change without notice.

TSI

TSI Incorporated
Environmental Measurements
and Controls Division

500 Cardigan Road
Shoreview, MN 55126 USA

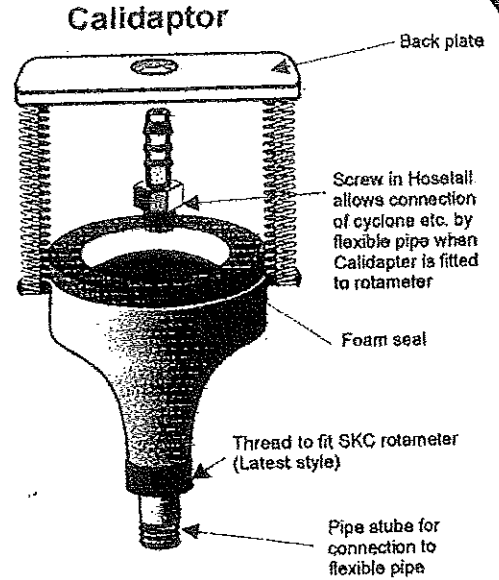
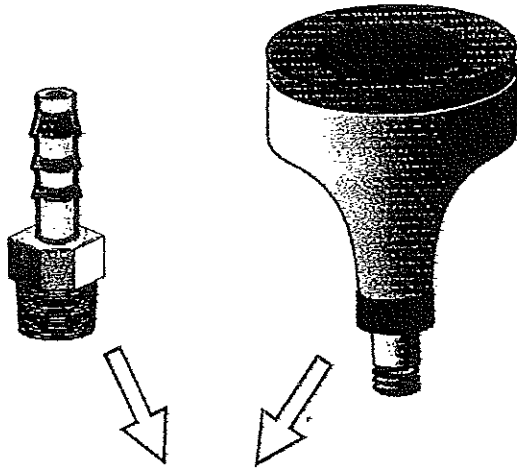
Telephone: 001 612 490 2807
Fax: 001 612 490 2874

Copyright © 1996 by TSI Incorporated

Printed in U.S.A.

BIRAL

Bristol Industrial &
Research Associates LTD.
P.O. Box No. 2
Portishead, Bristol BS20 9JB
England

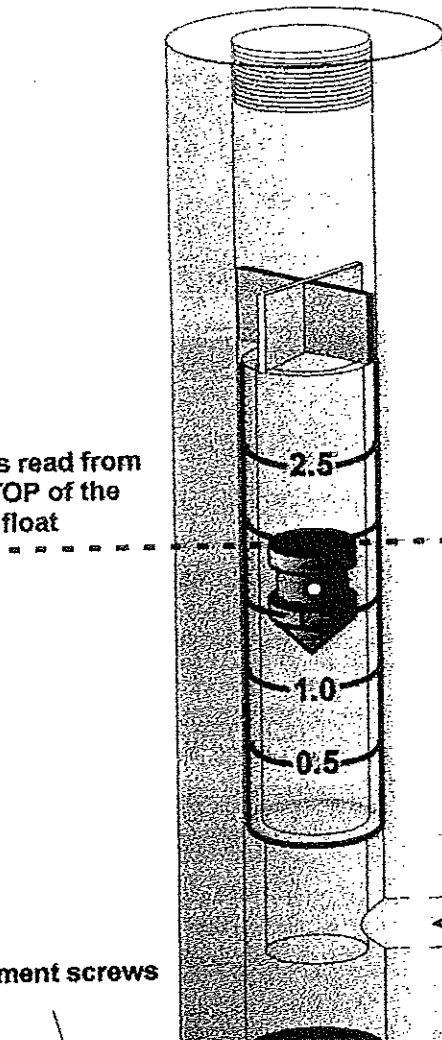


The SKC rotameter is supplied with an adapter and two pipe stub fittings which should be screwed into position as shown in the diagram opposite. This provides a method of connecting either a sampling head or flexible pipe to the rotameter.

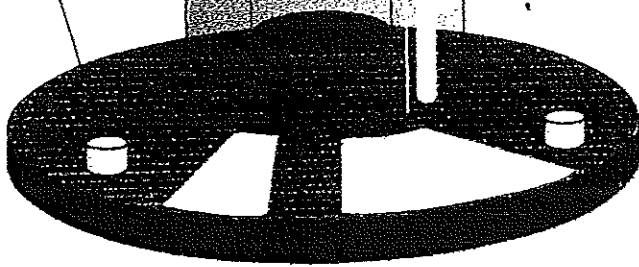
When using an I.O.M. head or similar, where there is no facility to connect a flexible pipe the SKC CALIDAPTOR allows hands free calibration and ensures a good air seal at all times.

To fit simply remove the pipe stub (if fitted) and replace it with the CALIDAPTOR. The sample head is now clipped between the spring loaded back plate and the foam seal. Once in place both hands are left free to set the pump flow rate.

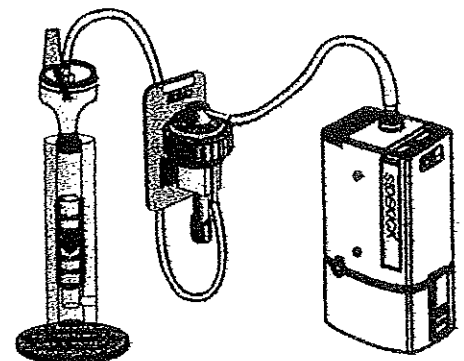
Always read from the TOP of the float



Adjustment screws



Pipe stub fitting



Set up showing cyclone being calibrated

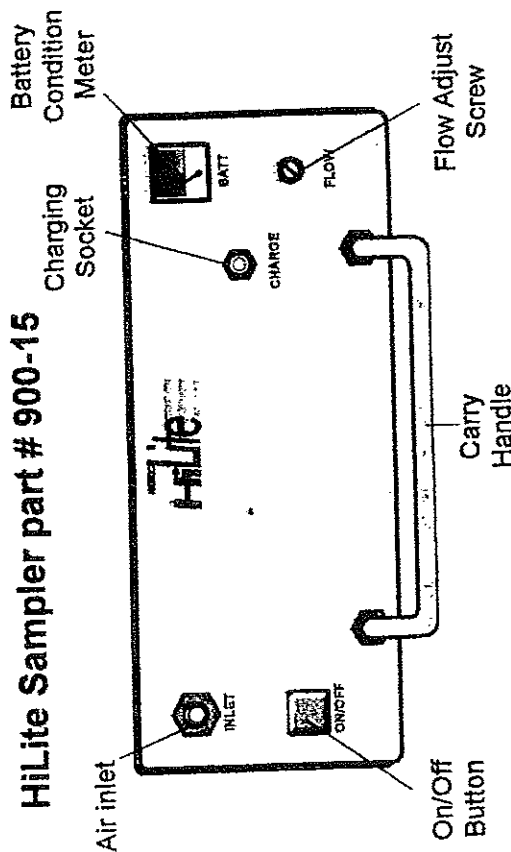
FEATURES

Where are the controls located? All the controls of the HiLite series are located on the front panel.

ON/OFF SWITCH. When pressed down to the ON position the pump will start to run, and the LCD (if fitted) activate showing eight ZEROS. If left running the timer will increase in one minute steps to a maximum of 9999999 minutes.

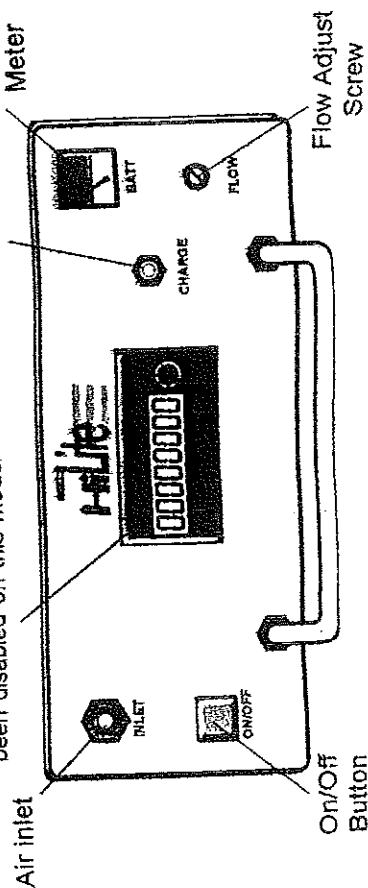
TIMER (if fitted). The red button on the timer is disabled on the HiLite pump and has no effect when pressed. Once the pump has been started the timer will record the run time in minutes. At the end of the sample the pump is stopped and the timer will freeze displaying the total run time. When the pump is next restarted the timer will zero and commence recording the run time once again.

HiLite Sampler part # 900-15



HiLite Sampler with Timer part # 900-15T

Electronic Timer. NOTE: The red button has been disabled on this model

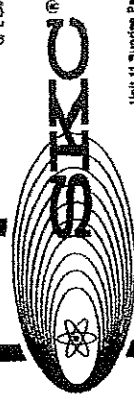


OPERATING
INSTRUCTIONS

FEATURING

HILITE
HIGH VOLUME
SAMPLING PUMP

SPECIALISTS IN AIR SAMPLING



Unit 11 Bundeek Park, Higher Sharncliffe Road
Blanchard Forum, Donat, DT11 2ST

☎ 01258 48 01 88 ☎ 01258 48 01 94

Published by SKC Ltd.



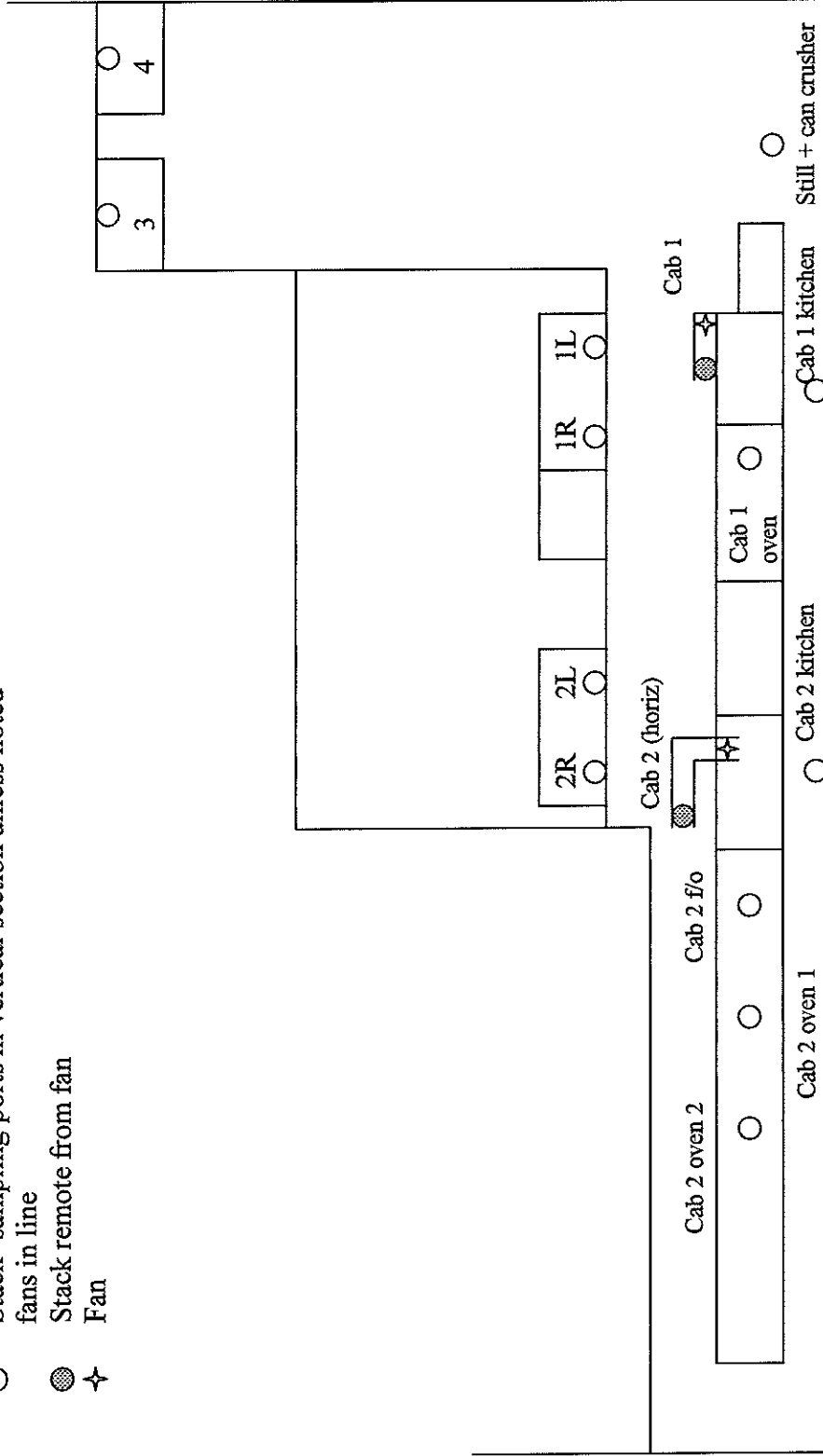
SKC
Life

Appendix 3- Location and Identification of Sampling Points

○ Stack- sampling ports in vertical section unless noted
fans in line

● Stack remote from fan

✦ Fan



Schematic of location and identification of sampling points

Appendix 4- Results

Particulate Matter Stack Monitoring

Stack Identification/Position	Left stack	Stack dimensions	700mm
Plant identification	Spraybooth 1	Process operation	spraying mixed materials

Sample Point	Air Velocity m/s	Isokinetic flow rate l/min	Filter Number	Particulate Weight milligrams	Total Time minutes	Total Volume litres	Particulate Concentration		Comments
							mg/m ³	mg/m ³	
parallel port, 0.15D	10.7	8.0	177	1.5	166	1328.0	1.2		
perpendicular port, 0.15D	10.1	7.6	95	1.7	177	1345.2	1.3		

Particulate Matter Stack Monitoring

Stack Identification/Position	Right stack	Stack dimensions	700mm
Plant identification	Spraybooth 1	Process operation	spraying mixed materials

Sample Point	Air Velocity m/s	Isokinetic flow rate l/min	Filter Number	Particulate Weight milligrams	Total Time minutes	Total Volume litres	Particulate Concentration mg/m ³	Comments

Particulate Matter Stack Monitoring

Stack Identification/Position	Left stack	Stack dimensions	700mm
Plant identification	Spraybooth 2	Process operation	spraying mixed materials

Sample Point	Air Velocity m/s	Isokinetic flow rate l/min	Filter Number	Particulate Weight milligrams	Total Time minutes	Total Volume litres	Particulate Concentration mg/m ³	Comments
perpendicular port, 0.15D	7.9	6.0	382	0.6	172	1032.0	0.6	
parallel port, 0.85D	12.3	9.2	375	0.8	175	1610.0	0.5	

Particulate Matter Stack Monitoring

Stack Identification/Position	Right stack	Stack dimensions	700mm
Plant identification	Spraybooth 2	Process operation	spraying mixed materials

Sample Point	Air Velocity m/s	Isokinetic flow rate l/min	Filter Number	Particulate Weight milligrams	Total		Particulate Concentration mg/m ³	Comments
					Time minutes	Volume litres		
perpendicular port, 0.15D	7.7	5.8	421	1.9	182	1055.6	1.8	
perpendicular port, 0.85D	10.7	8.0	195	1.7	174	1392.0	1.2	

Particulate Matter Stack Monitoring

Stack Identification/Position	Stack	Stack dimensions	700mm
Plant identification	Spraybooth 3	Process operation	spraying mixed materials

Sample Point	Air Velocity m/s	Isokinetic flow rate l/min	Filter Number	Particulate Weight milligrams	Total Time minutes	Total Volume litres	Particulate Concentration mg/m ³	Comments

Particulate Matter Stack Monitoring

Stack Identification/Position	Stack	Stack dimensions	700mm
Plant identification	Spraybooth 4	Process operation	spraying mixed materials

Sample Point	Air Velocity m/s	Isokinetic flow rate l/min	Filter Number	Particulate Weight milligrams	Total Time minutes	Total Volume litres	Particulate		Comments
							Concentration mg/m ³		
perpendicular port, 0.15D	6.9	5.2	6	0.3	180	936.0	0.4		mainly staining
perpendicular port, 0.85D	8.3	6.3	436	2.9	178	1121.4	2.6		

Particulate Matter Stack Monitoring

Stack Identification/Position	Stack	Stack dimensions	650mm
Plant identification	Spray cab 1	Process operation	patina

Sample Point	Air Velocity m/s	Isokinetic flow rate l/min	Filter Number	Particulate Weight milligrams	Total		Particulate Concentration mg/m ³	Comments
					Time minutes	Volume litres		
upper port, 0.85D	9.3	7.0	308	5.3	83	581.0	9.2	patina stain only, low usage, 40 min spraying

Particulate Matter Stack Monitoring

Stack Identification/Position Stack	Stack dimensions	550mm
Plant identification	Process operation	lacquer
Spray cab 2		

Sample Point	Air Velocity m/s	Isokinetic flow rate l/min	Filter Number	Particulate Weight milligrams	Total Time minutes	Total Volume litres	Particulate Concentration mg/m ³	Comments
left port, 0.15D	15.5	11.7	461	2.7	149	1743.3	1.6	
right port, 0.85D	13.9	10.5	498	1.4	158	1659.0	0.9	

Velocity measurement

Spraybooths - air flow in exhaust stacks

duct identification	diameter mm	air velocity m/s										average velocity m/s	measured air volume m ³ /hr	static pressure pascals
		1	2	3	4	5	6	7	8	9	10			
spraybooth 1 left stack, perpendicular port	700	12.2	12.5	10.1	8.3	8.5	9	9.1	8.9	10.9	10.3	9.98	13,826	130
spraybooth 1 left stack, parallel port	700	11.2	11.4	10.7	10.1	8.2	15	16.5	16.4	16	13.8	12.93	17,913	
spraybooth 1 right stack, perpendicular port	700	12.2	12.4	9.7	8.8	10	12.7	12.3	12.8	12.6	13.4	11.69	16,195	120
spraybooth 1 right stack, parallel port	700	14.9	16.4	16.8	16.5	12.4	13.4	15.5	12.6	13	11	14.25	19,742	
spraybooth 2 left stack, perpendicular port	700	5.2	5.9	7.9	8.5	9	9.9	10	10.8	11	8	8.62	11,942	40
spraybooth 2 left stack, parallel port	700	10	12.5	13.9	13.2	11	11.2	12.3	12.3	12.3	10.9	11.96	16,569	
spraybooth 2 right stack, perpendicular port	700	11.6	8.4	7.7	7.9	9.1	9.4	9.3	10.7	11.3	12	9.74	13,494	45
spraybooth 2 right stack, parallel port	700	14.7	14.5	14.6	14	10.4	10.6	12.8	14.8	14.7	13	13.41	18,578	

Velocity measurement

Spraybooths - air flow in exhaust stacks

duct identification	diameter mm	air velocity m/s										average velocity m/s	measured air volume m ³ /hr	static pressure pascals
		1	2	3	4	5	6	7	8	9	10			
spraybooth 3 perpendicular port	700	6.2	6.5	7.5	9	11.7	11.3	8.8	9.3	9	3	8.23	11,402	110
spraybooth 3 parallel port	700	18.2	18.9	18.7	18.1	15.1	12	14.6	15.3	15.2	14	16.01	22,180	
spraybooth 4 perpendicular port	700	7.1	5.4	6.9	7.7	10.1	11.1	8.6	8.3	6	3	7.42	10,280	115
spraybooth 4 parallel port	700	19.2	19.3	18.9	17.1	12.7	13.4	16.2	16.6	15.9	14.2	16.35	22,651	
spray cab 1 right port	650	8.3	7.7	6.1	3.8	6	9.6	10.5	11	11.6	11.3	8.59	10,261	60
spray cab 1 left port	650	11.6	12	11.2	10.5	10.1	9.8	9.1	9.3	9.1	8.4	10.11	12,077	
spray cab 2 right port	550	16.7	16.3	16.1	16	15.7	15.2	14.9	13.9	13.6	11.3	14.97	12,803	170
spray cab 2 left port	550	15.6	15.4	15.5	15.2	15	15.4	15.5	15.5	15.7	13.8	15.26	13,051	

Velocity measurement

Spraybooths - air flow in exhaust stacks

duct identification	diameter mm	air velocity m/s										average velocity m/s	measured air volume m ³ /hr	static pressure pascals		
		1	2	3	4	5	6	7	8	9	10					
spray cab 2 flash-off right port	350	11.6	8.8	9.1	9	9.8	10.7							9.833333	1,346	40
spray cab 2 flash-off left port	350	6.1	7.8	8.1	8.7	9.7	10.4							8.466667	1,502	
spray cab 2 oven 1 right port	250	9.6	9.6	9.8	10.7	12.3	13.2							10.9	1,122	65
spray cab 2 oven 1 left port	250	10.8	11.7	10.4	10.0	11.2	11.7							11.0	1,938	
spray cab 2 oven 2 right port	250	11.7	12.9	13.2	14.2	15.5	12.9							13.4	2,368	115
spray cab 2 oven 2 left port	250	13.1	13.8	13.8	13	12.6	11.9							13.0	2,303	
cab 1 kitchen	250	7.2	8.2	8.8	7.7	7.2	6.6							7.6	1,346	110
cab 2 kitchen	250	7.3	8.4	9.5	9.3	8.5	8.0							8.5	1,502	125
still + can crusher	250	7.7	7.6	7.1	6.1	4.8	4.8							6.4	1,122	105