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
1a Astwick Road
Stotfold
Hitchin
Herts. SG5 4AP

tel 01462 732682

Report by [redacted]

Date: - December 2000

Contents

Introduction

This report relates to a visit to the premises of Burbidge & Son Ltd. at Awson Street in Coventry on 12th & 13th December 2000 and subsequent dates to complete measurements on new stain cab stack and additional measurements requested by the Local Authority. The purpose of this visit was to carry out emissions monitoring as part of compliance with the Environmental Protection Act PG6/33(97) Secretary of State's Guidance- Wood Coating Processes. The process is authorised by City of Coventry authorisation number 045.

The emission points were monitored for volatile organic compounds (VOC) and for particulate matter.

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
- MDHS 70- General methods for sampling airborne gasses and vapours
- BS 3405- Measurement of particulate emission including grit and dust (simplified 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
- Stack sampling protocol- Measurement of Volatile Organic Compounds

These protocols were submitted to the Authority prior to monitoring and 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
- SKC universal constant flow pump and dry-flo flowmeter
- In-stack particulate filter head using 4mm nozzle

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. BS3405 Section 8.3
   This requires that the particulate sample collected is a minimum percentage weight of the container mass. It was found with these measurements that even with considerably extended sampling times it was generally not possible to achieve this minimum. The results however are consistent between the normal and extended sampling times.
2. BS3405 Section 11
   Due to the variable work patterns at the spraying positions and the need to run extended sampling it was not always possible to sample the same coating material each time in each stack. This has therefore led to a larger variation between measurements than specified.
3. Air velocity at sampling point
   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 at the 0.15D and 0.85D particulate sampling points and used to determine the sampling volume. The air velocity measurements did however satisfy the requirements of BS3405 section 6.3.2. Repeat air velocity measurements at the sampling points gave readings generally similar to the original although the turbulence made this difficult to quantify.
4. Occupancy of booths
   The occupancy of the manual 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.
5. 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 the guidance position.

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	VOC emissions
	average mg/m^3	mg/m^3
Spraybooth 1- left	3.2	24.36
Spraybooth 1- right	0	44.83
Spraybooth 2- left	1.3	9.41
Spraybooth 2- right	1.1	27.55
Spraybooth 3	1.2	1.7
Spraybooth 4	0.9	0.38
Stain cab	10/54	155.30
Stain flash-off	n/a	3.65
Lacquer cab	0.9	128.17
Lacquer flash-off	n/a	162.23
Oven 1	n/a	20.19
Oven 2	n/a	6.24

Conclusions
The particulate emissions are 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/m^3 for normal conditions and 10-15 mg/m^3 for high use or poor filter condition.

One of the particulate emissions for the stain cab is relatively high due mainly to the nature of the dry patina stain being applied at the time of sampling. This probably represents the worst case. The lacquer cab is a new specification and as such is specified to achieve the 3 mg/m^3 limit set in the German environmental legislation (TA- Luft).

The VOC emissions are typical for the industry and represent the different coatings and different occupancy of the spraying positions.

12/13th Dec 2000

Appendix 1- Sampling Protocols and pre-monitoring information

Pre-monitoring information

Company	Burbidge & Son Ltd
Address	Awson Street Coventry
Contact	Mr J Gwilliam
Monitoring	Emissions from spray booths and automatic spray line to be tested for particulates and volatile organic compounds to comply with City of Coventry Environmental Protection Act 1990 Authorisation Number 045. Monitoring locations shown on enclosed drawing. All locations are internal and accessible from a short ladder run to minimise health & safety risk.
Contractor	Mike Thomas BSc MSc 1a Astwick Road Stotfold Hitchin Herts SG5 4AP affilliated to IEMA
Laboratory	Mountainheath Services Ltd Unit N, Gunnels Wood Park Gunnels wood Road Stevenage Herts SG1 2BH ukas accredation
Date/time	Provisionally set for Tuesday 28th November, all day.
Enclosures	Measurement of airflow Measurement of particulate matter Measurement of volatile organic compounds Location drawing

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 of linear flow. BS 3405 states specific minimum distances, in terms of stack diameters, from points of turbulence e.g. fan (3), junction (2) or bend (1). It also states 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.

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 BS 3405. In situations where the airflow is not linear, preference is given to measuring air velocity at the points where sampling will occur.

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 15-30 minute period at points specified in BS 3405. 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. Measurement are taken without correction for water vapour content.

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

Stack Sampling Protocol- Measurement of Volatile Organic Compounds

1. Measurements and Analysis
   The quantity of VOC's in a stack is measured by collecting a sample on a charcoal adsorption tube. This sample is subsequently analysed by a combination of Gas Chromatography and Mass Spectroscopy and the weight of VOC's calculated as total carbon.

2. Sampling
   A 6mm stainless steel probe is inserted into the stack and connected to the charcoal adsorption tube. The flue gasses are pumped through the adsorption tube for 20-50 minutes at a rate of 100-200 ml/min.

3. Presentation of results
   The volume of air sampled is derived from the sampling flow rate and the sampling time. The volume is expressed in cubic metres.

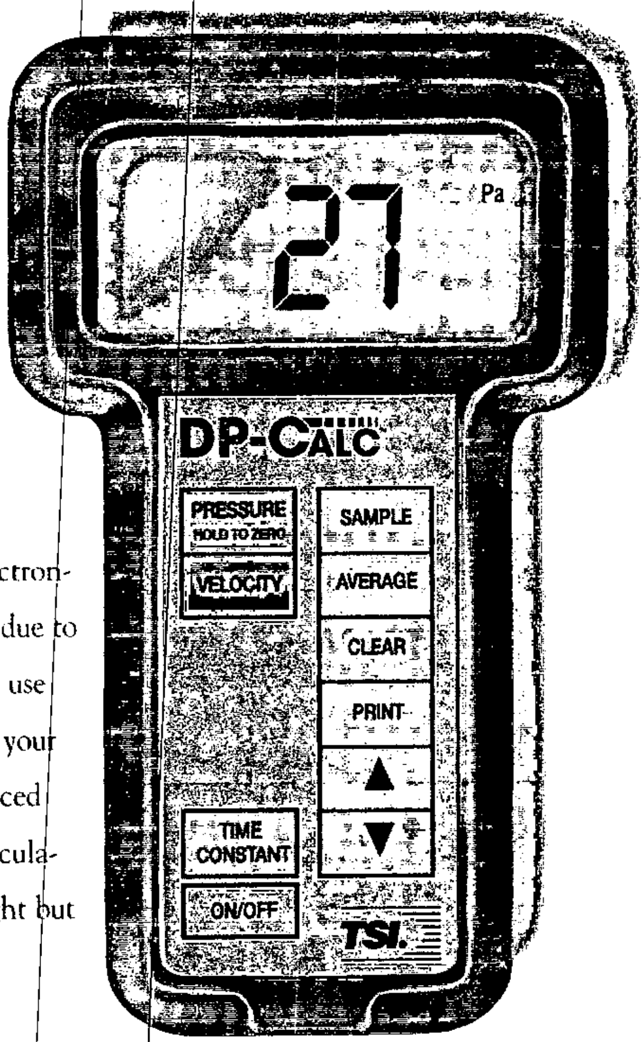
   The GC-MS analysis of the flue gasses and subsequent calculation gives the weight of VOC's in total carbon.

   The concentration of volatile organic compounds is expressed as milligrams per cubic metre or $mg.m^{-3}$.

Appendix 2- Equipment Used

TSI's DP-CALC™ Micromanometers allow you to easily make the HVAC differential pressure measurements you need. Differential pressure readings include static pressure, total or velocity pressure, as well as the difference from one area to another. The DP-CALC can be used to measure pressure and velocity in ductwork, pressure drops across filters or coils to determine performance, differential from room to room as in clean rooms or abatement areas and differential from the building to the outside for indications of indoor air quality problems. The DP-CALC can be used by anyone - test and balance professionals, HVAC technicians, facility engineers, maintenance workers, building owners and managers, inspectors and consultants.

The microprocessor-based DP-CALC uses the latest in electronic pressure transducer technology, eliminating sensitivity due to the orientation of the meter. Combined with the easy to use zeroing function, this allows you to be more confident in your readings. There are two models available, with an advanced model that includes data logging and volumetric flow calculations. Each model of the DP-CALC combines a lightweight but durable design with an easy to read display.



Model 8702

Model 8702

The Model 8702 DP-CALC measures the differential pressure, calculates velocity, and averages up to 255 data points. The data can then be printed to a portable printer to produce a hard copy of your readings. Easy to use, this model is a cost effective alternative for your differential pressure measurement needs.

TSI®

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. H_2O)
Accuracy: ±1% of reading ±1 Pa (±0.01 mm Hg, ±0.005 in. H_2O)
Resolution: 1 Pa, 0.01 mmHg (0.001 in. H_2O)

Velocity:
Range[1]: 1.25 m/s to 78.5 m/s (250 ft/min - 15,500 ft/min)
Accuracy[2]: ±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[3]: to 9,999,000 ft^3/min, m^3/h, l/s
K 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
4 - size AA batteries
1 - NIST certificate of calibration
1 - operation and service manual

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

[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.

TSI.

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P.O. Box No. 2
Portishead, Bristol BS20 9JB
England

TSI CERTIFICATE OF CALIBRATION AND TESTING

TSI Model 8705-M-GB TSI Serial No. 00110061

Description DP-CALC MICROMANOMETER

Calibration Standard PRESSURE CALIBRATION SYSTEM, SERIAL NO.110

CALIBRATION VERIFICATION RESULTS

Calibration Standard	*Instrument Output*	*Error Percent*	*Error Compared to Tolerance* (*Tolerance -Limit* / *0* / *Tolerance Limit +*)
-1010.6 Pa	-1010.3 Pa	-0.0	*
-494.6 Pa	-494.3 Pa	-0.1	*
497.6 Pa	495.1 Pa	-0.5	* ·
1021.8 Pa	1018.2 Pa	-0.4	* ·
2245.2 Pa	2243.6 Pa	-0.1	*·
2992.3 Pa	2990.8 Pa	-0.0	*

Tolerance Limits:
±1.0% of reading ±1 Pa
±1.0% of reading ±.005 in. H2O
±1.0% of reading ±.01 mm Hg

TSI corporated does hereby certify that all materials, components, and workmanship used in the manufacture of this equipment are in strict accordance with the applicable specifications agreed upon by TSI and the customer and with all published specifications. All performance and acceptance tests required under this contract were successfully conducted according to required specifications. Furthermore, all test and calibration data supplied by TSI has been obtained using standards whose accuracies are traceable to the National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. Calibration procedures for this instrument comply with MIL-STD-45662A. The accuracy of the calibration facilities is greater than a ratio of 1:1 with respect to the accuracy specifications of the instrument being calibrated.

Applicable Test Report	Report Number	Date Last Verified
DC voltage	517979	09-18-00
Pressure	822/260205-98	05-08-00
	822/258703-97	05-08-00

U. Swanson
Calibrated by

☒ Final
Function Check

Nov 03, 2000
Calibration Date

TSI Incorporated
Environmental Measurements
and Controls Division

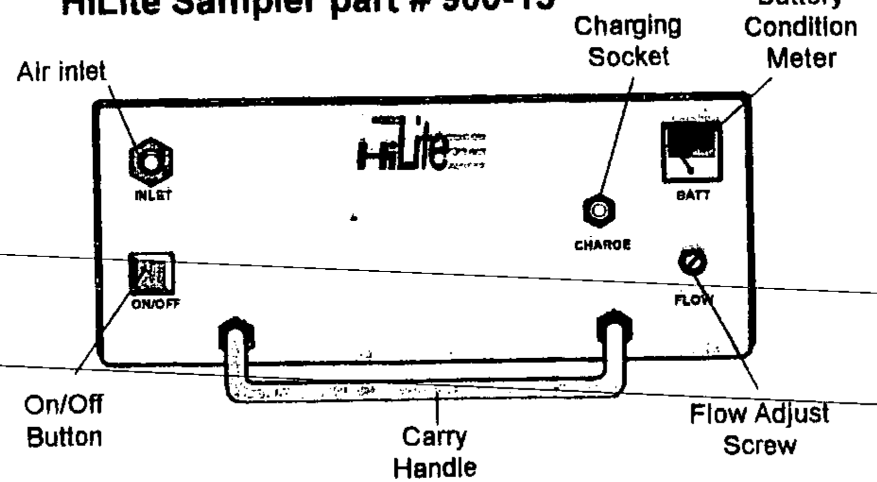
Mailing Address: P.O. Box 64394 St. Paul, MN 55164 USA
Shipping Address: 500 Cardigan Road Shoreview, MN 55126 USA
Phone: (800) 777-8356 or (651) 490-2711 **Fax:** (651) 490-2874

FEATURES

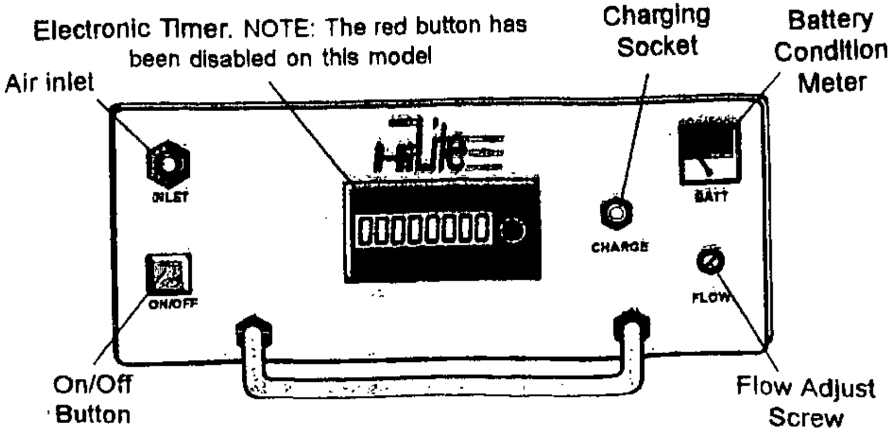
Where are the controls located? All the controls of the HiLite series are located on the front panel.

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 99999999 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



FLOW ADJUST. Below the level of the hole marked FLOW is a small screw. To adjust the flow use a small screwdriver, making sure the screwdriver end is located in the slot. To increase the flow turn clockwise. The span of this screw is around 5 turns. **DO NOT FORCE** the flow adjust screw, and Flow range by this adjuster is approximately 3-12 l/min.to free air.
BATTERY CHARGE METER. The meter gives an indication of the battery capacity available. If the meter is in the RED area the pump should be recharged before use.
INLET. Connect the sampling device to this pipe stub using flexible tubing of 6mm diameter.
FUSE. An internal fuse is fitted which can only be accessed by removal of the case top. Please refer to page 4 for instructions on how to remove case top. The fuse is rated at 2 Amp anti surge and **must** be replaced with an equivalent. Replacement of the fuse with a higher or lower value can cause damage to your pump.
CHARGING. The charger for the HiLite will automatically switch to a trickle charge after the battery has reached full charge. This prevents overheating of the battery and increases its life.

SKC

SKC Lite

OPERATING INSTRUCTIONS

FEATURING

HILITE HIGH VOLUME SAMPLING PUMP

SPECIALISTS IN AIR SAMPLING

SKC®

Unit 11 Sunrise Park Higher Shaftesbury Road Blandford Forum Dorset DT11 8ST
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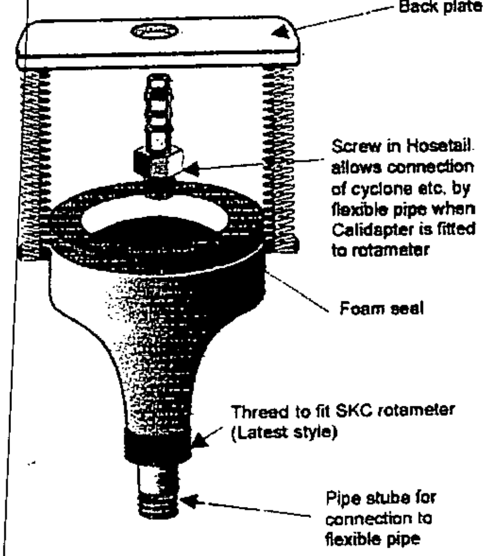
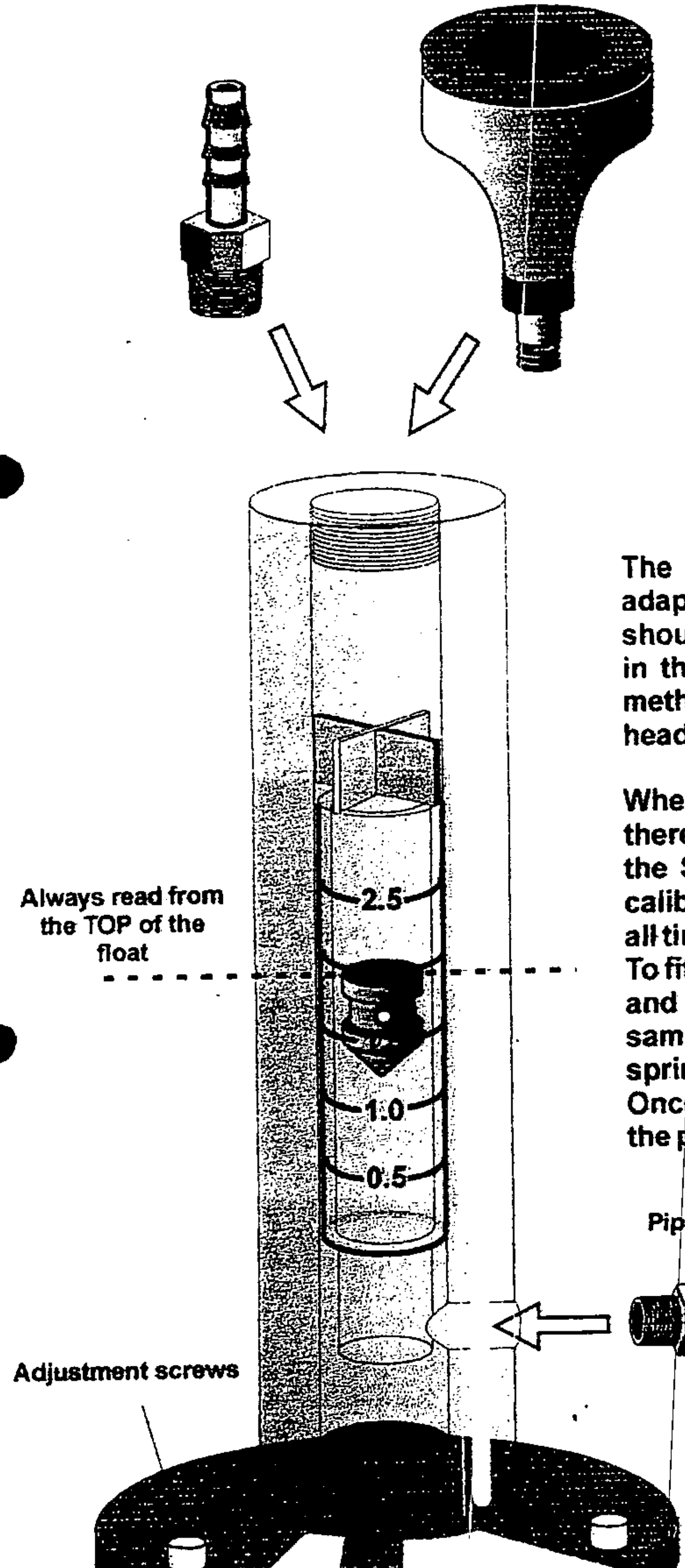
Published by SKC Ltd.

CE

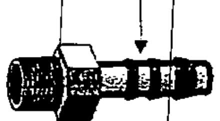
Calidaptor

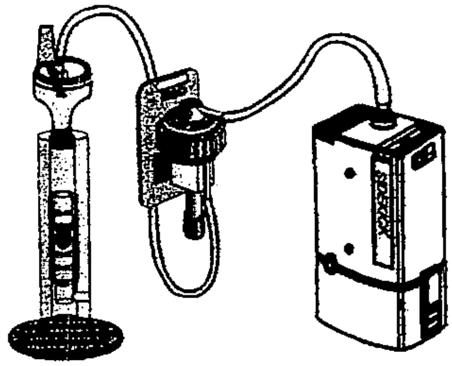




The SKC rotameter is supplied with an adapter and two pipe stub fittings which should be screwed into position as shown in the diagram opposite. This provides a method of connecting either a sampling head or flexible pipe to the rotameter.

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.

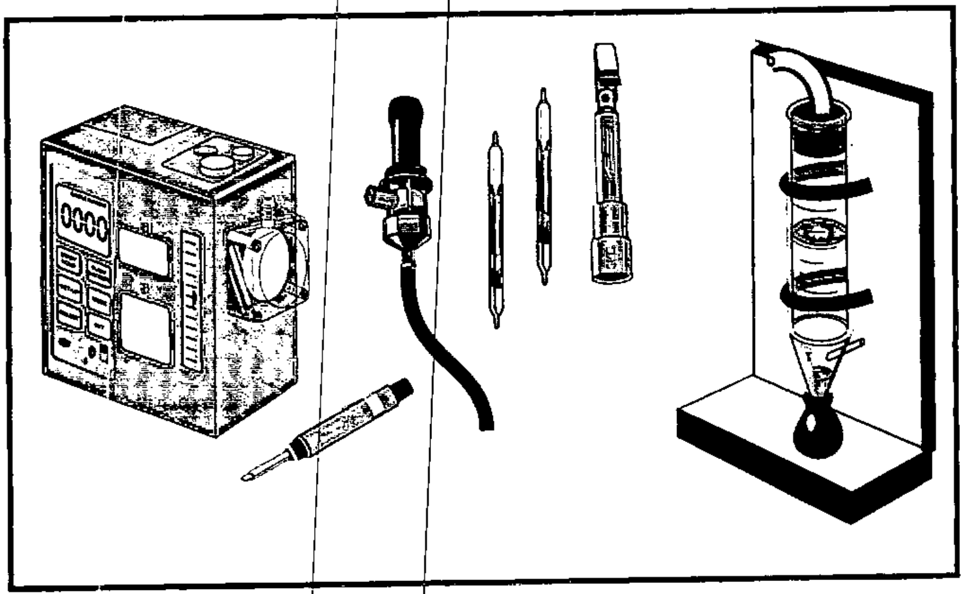


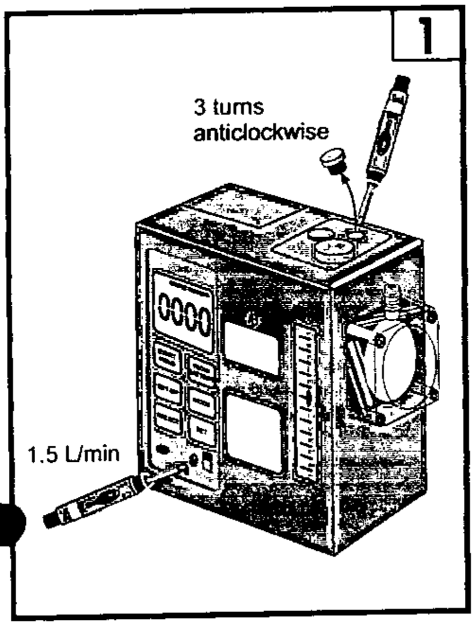


Set up showing cyclone being calibrated

E. GAS SAMPLING USING SORBENT TUBES

You will need :-
Sampling pump (fully charged)
Low flow adapter (tube holder)
Tube cover of appropriate size for tube you are using
Two sorbent tubes. One is to be used to set the flow and one used for the sample
Calibration equipment capable of measuring the intended flow typically between 5 & 500 Millilitres per minute.
Toolkit to adjust flow



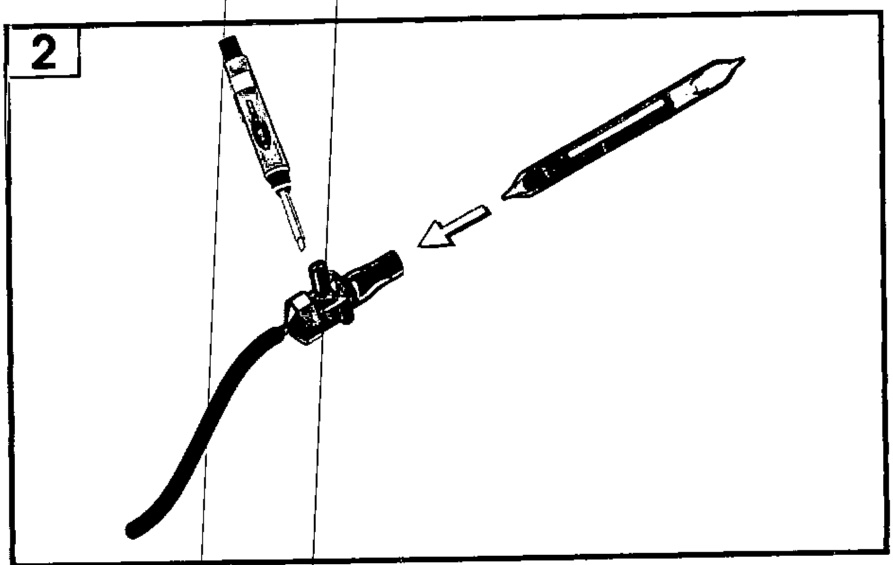


1. THE SAMPLING PUMP MUST BE IN THE HIGH FLOW MODE TO ENABLE SETTING OF FLOW BEFORE IT CAN BE ADAPTED TO LOW FLOW USE.

Check the Universal pump is in the High Flow made by making sure the screw under the small round knurled cover is in the closed position. The closed position is when the screw under the cover is fully screwed down. Set the flow to 1.5 litres per minute using the flow adjust screw on the front of the pump. Once the flow has been set in the HIGH FLOW MODE, undo the screw under the small knurled cover 3 turns anticlockwise. This now puts the pump into the LOW FLOW MODE and allows the use of the low flow adapter. The combined low flow adapter and tube holder is now connected to the pump. The inlet pipe stub on the Universal can be found pointing upwards from the clear plastic cover on the right hand side of the pump. The filter contained inside this cover is not of concern for sampling and only acts as a protection device for the pump internals.
NOTE: The flow adjustment screw for low flow applications is to be found projecting from the side of the low flow adapter. DO NOT USE THE FLOW ADJUST SCREW ON THE PUMP ITSELF WHILE IN THE LOW FLOW MODE (see sketch 2, below.)

2. Take one of the sorbent tubes and break off both ends. Place the tube into the short black rubber hose of the low flow adapter.

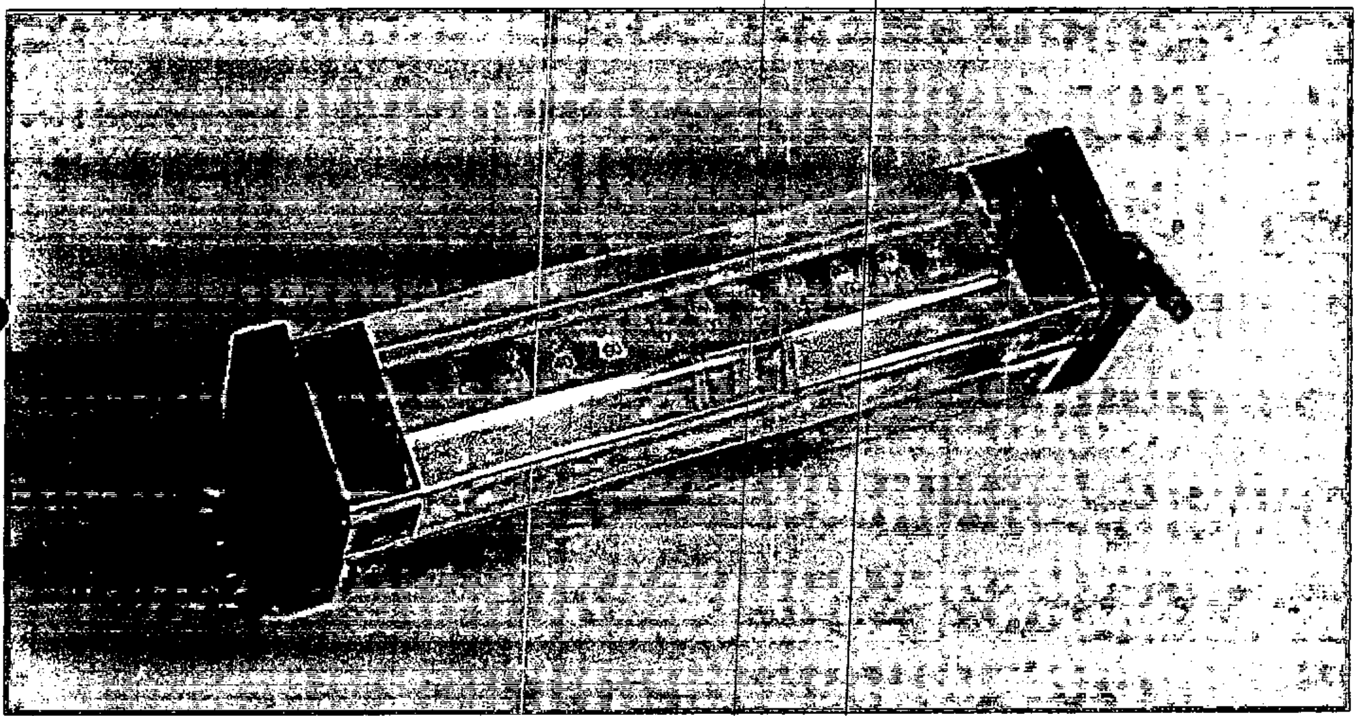
3. To determine which way the tube should face look for a printed arrow on the glass tube. If this is present it should face towards the pump. The arrow shows the direction of air flow. If there is no arrow on the tube the largest air gap or unfilled section of the tube should face away from the pump, to atmosphere.



J.S. HOLDINGS

DRY-FLO FLOWMETER MODEL 100A

OPERATING INSTRUCTIONS



Description of Operation

A hollow glass cylinder and near frictionless diaphragm form the measurement element. As gas is introduced or evacuated from one end of the cylinder, the diaphragm is displaced by an equal volume. The flow rate (using an external timer) or volume sampled is read off from a graduated scale.

Construction

The tube and diaphragm of the measuring element are constructed from borosilicate glass with plastic sealing caps. A steel channel with aluminium connector blocks secures the glass tube. The top of the instrument is protected by a transparent dust cover.

Applications

The DRY-FLO calibrator can be used for the calibration of either:

gas flow-rate (using an external timer)
sample volumes up to a maximum volume of 100 ml

Typical applications include calibration of:

low flow air sampling pumps
hand pumps for indicator tubes
(e.g. Draeger, Gastec)

WARNING:

THE CALIBRATOR IS NOT COMPATIBLE WITH LIQUIDS

JS Holdings
Unit 6 Leyden Road
Stevenage
Hertfordshire
SG1 2BW
T: 01438 316994
F: 01438 316995

Certificate of Calibration

This Dry Flo Flowmeter, model 100A, serial number 0156 has been calibrated against an adjustable precision gas tight syringe, of nominal volume 100ml, which has been calibrated by filling with distilled water and determining the weight of water delivered in accordance with the general principles contained in British Standard Specification 6696:1986 and BS 6018:1991 or BS 7532:1991 as appropriate. At least ten determinations were made at each volume and the mean value was used to compute the measured volume. The weights used in the determination were a stainless steel reference set numbered ST1/831310, which have a certificate issued by the National Physical Laboratory, reference number 08C021/9506, and a stainless steel reference set numbered ST1/852298-860416, which have a certificate, issued by the National Physical Laboratory reference number 08C021/9402.

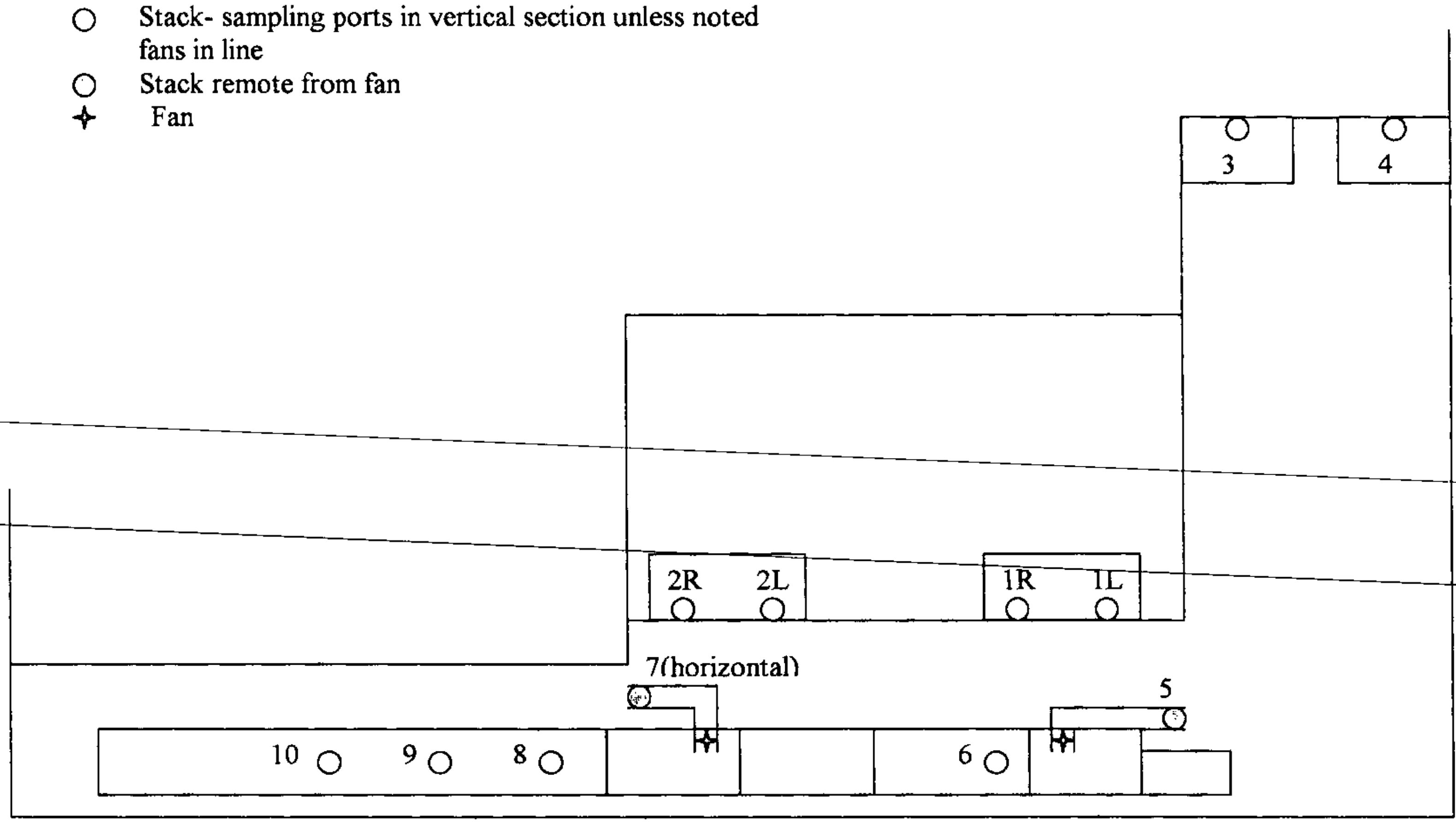
The measurement results are given in the table below, where each value given in the second column represents the average of three readings of the measured delivered volume of air at 20°C represented by the nominal value identified in the first column. The Uncertainty of Measurement is ± 0.2ml.

Nominal Value (ml)	Measured Volume (ml)	Accuracy %
20 (From 0 to 20)	19.00	98.00
40 (From 0 to 40)	38.50	96.25
60 (From 0 to 60)	58.50	97.50
80 (From 0 to 80)	78.60	98.25
100 (From 0 to 100)	98.00	98.00

Certificate number 0140

The uncertainties are for a confidence probability of not less than 95%

Appendix 3- Location and Identification of Sampling Points



Schematic of location and identification of sampling points

Appendix 4- Results

Test Point	Port	Duct Dia mm	air velocity m/s at standardised temperature and pressure										Average air velocity m/sec	Static Pressure pa.	Actual Air Vol cu.m/hr	Comments
1 left	perpendicular	700	10.9	11.8	9.0	8.9	9.0	10.8	11.5	12.1	13.7	13.3	11.1	80	15,378	
1 left	parallel	700	10.0	10.5	10.3	9.2	9.3	8.8	9.5	11.2	13.4	10.7	10.3		14,256	
1 right	perpendicular	700	11.1	11.1	10.0	7.7	11.0	11.5	13.1	13.1	15.5	12.8	11.7	110	16,195	
1 right	parallel	700	12.5	12.5	15.5	15.7	12.8	11.7	12.1	13.0	13.7	7.1	12.7		17,539	
2 left	perpendicular	700	8.9	7.5	8.7	7.2	8.2	9.5	10.1	8.8	9.0	5.4	8.3	45	11,540	
2 left	parallel	700	9.9	12.8	13.9	13.4	11.6	10.2	10.9	8.8	6.8	4.0	10.2		14,173	
2 right	perpendicular	700	10.8	10.3	7.8	8.7	8.3	8.3	8.4	7.5	7.1	4.0	8.1	30	11,249	
2 right	parallel	700	13.4	14.5	13.9	13.5	10.5	10.5	12.5	13.5	11.2	7.6	12.1		16,777	
3	perpendicular	700	2.0	4.5	6.8	7.9	10.3	10.3	8.9	8.1	9.2	1.8	7.0	115	9,670	
3	parallel	700	16.5	17.4	17.8	16.4	13.2	11.9	15.9	15.3	14.3	11.4	15.0		20,795	
4	perpendicular	700	0.0	0.0	6.0	7.1	9.2	10.5	8.4	7.5	5.7	0.0	5.4	120	7,537	
4	parallel	700	14.2	15.6	15.8	14.9	12.5	13.6	13.8	16.8	16.1	15.8	14.9		20,656	
5	right	640	7.6	8.8	8.9	9.0	9.1	8.9	8.8	8.6	7.8	6.2	8.4	45	9,687	
5	left	640	7.5	8.3	8.8	9.1	9.2	9.1	8.9	8.6	7.6	6.4	8.4		9,670	
6		250	17.8	17.5	16.3	16.8	17.9	17.9	17.9	17.9	17.8	15.7	17.4	250	3,086	
7	left	550	17.5	17.2	16.5	16.3	16.3	15.9	15.7	15.6	15.4	14.8	14.4	200	12,290	
7	right	550	18.1	17.7	17.5	17.1	16.4	15.5	15.0	13.9	13.7	12.9	15.8		13,496	
8	left	350	6.1	6.9	8.1	8.4	8.3	9.3	10.0	10.7	10.6	9.1	8.8	60	3,031	
8	right	350	8.3	9.3	9.7	9.2	9.1	9.1	9.2	9.8	9.8	8.0	9.2		3,169	
9	left	250	10.5	10.4	11.0	9.8	9.9	10.9	10.8	11.6	10.7	9.8	10.5	85	1,863	
9	right	250	9.5	9.9	9.8	9.5	10.3	10.7	11.3	12.5	12.6	11.7	10.8		1,905	
10	left	250	14.0	14.8	15.0	15.2	15.2	14.3	14.2	13.3	12.6	10.6	13.9	150	2,460	
10	right	250	11.8	13.0	13.2	14.0	15.2	15.3	15.4	14.8	14.5	12.5	14.0		2,469	

Stack Id.	Plant Identification	Material Sampled	Pump Rate ml/min	Total Time minutes	Total Volume litres	VOC weight total carbon microgram	VOC concentration mg/cu. metre	Comments
1L	spraybooth 1- left stack	S&R 40:359-	160	30	4.8	116.95	24.36	
1R	spraybooth 1- right stack	S&R 42:34/102	142	10	1.42	63.66	44.83	relatively high volume spraying
1R	spraybooth 1- right stack	gunwash 01:60	165	1	0.165	0.84	5.09	gun cleaning
2L	spraybooth 2- left stack	S&R 40:359-	109	30	3.8	35.77	9.41	
2R	spraybooth 2- right stack	BA DL-2011	150	34	5.1	140.52	27.55	
3	spraybooth 3	S&R 40:359-	150	30	4.5	7.67	1.7	
4	spraybooth 4	S&R 04:34 C6574	135	30	4.05	1.53	0.38	

Stack Id.	Plant Identification	Material Sampled	Pump Rate ml/min	Total Time minutes	Total Volume litres	VOC weight total carbon microgram	VOC concentration mg/cu. metre	Comments
5	stain cab	BA DL-2011	150	20	4.5	698.86	155.3	
6	stain flash-off oven	S&R 04:34 C6574	150	30	4.5	16.43	3.65	
7	lacquer cab	S&R 40:359-	162	20	3.24	415.26	128.17	
8	lacquer flash off	S&R 40:359-	135	30	4.05	658.05	162.23	
9	oven 1	S&R 40:3739	150	30	4.5	90.83	20.19	
10	oven 2	S&R 40:3739	150	30	4.5	28.07	6.24	

Particulate Matter Stack Monitoring

Stack Identification/Position	- 1left	Stack dimensions	700mm diameter
Plant identification	- spray booth 1	Process operation	spraying patina and lacquer

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/m3	Comments
perpendicular 0.15D	10.3	7.7	325	0.5	14	108	4.6	relatively high volume spraying
perpendicular 0.85D	11.2	8.4	83	0.6	30	252	2.4	
parallel 0.15D	9.0	6.8	271	2.1	118	802	2.6	
parallel 0.85D								

Particulate Matter Stack Monitoring

Stack Identification/Position	-1 right	Stack dimensions	700mm diameter
Plant identification	- spray booth 1	Process operation	wiping patina

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/m3	Comments
perpendicular 0.15D	10	7.5	404	0	132	990	0	very low occupancy
perpendicular 0.85D								
parallel 0.15D								
parallel 0.85D								

Particulate Matter Stack Monitoring

Stack Identification/Position	- 2 left	Stack dimensions	700mm diameter
Plant identification	- spraybooth 2	Process operation	brushing patina

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/m3	Comments
perpendicular 0.15D	8.7	6.5	6	0	30	195	0	
perpendicular 0.85D	8.8	6.6	174	0.2	30	198	1	
parallel 0.15D	13.9	10.5	345	1	30	315	3.2	spraying pigmented lacquer
parallel 0.85D	8.8	6.2	435	0.2	30	186	1.1	spraying pigmented lacquer

Stack Identification/Position	- 2right	Stack dimensions	700mm diameter
Plant identification	- spray booth 2	Process operation	spraying lacquer

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/m3	Comments
perpendicular 0.15D	7.8	5.9	84	0.6	90	531	1.1	very low occupancy
perpendicular 0.85D								
parallel 0.15D								
parallel 0.85D								

Particulate Matter Stack Monitoring

Stack Identification/Position	- 3	Stack dimensions	700mm diameter
Plant identification	- spray booth 3	Process operation	spraying lacquer

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/m3	Comments
perpendicular 0.15D	6.8	5.1	323	0.8	106	540	1.5	
perpendicular 0.85D								
parallel 0.15D	17.8	13.4	421	1.3	120	1608	0.8	
parallel 0.85D								

Particulate Matter Stack Monitoring

Stack Identification/Position	- 4	Stack dimensions	700mm diameter
Plant identification	- spray booth 4	Process operation	spraying patina

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/m3	Comments
perpendicular 0.15D	7.5	5.7	45	0.1	100	570	0.2	
perpendicular 0.85D								
parallel 0.15D	15.8	12	497	0.5	30	360	1.4	
parallel 0.85D	16.8	12.6	62	0.4	30	378	1.1	

Particulate Matter Stack Monitoring

Stack Identification/Position - 5		Stack dimensions	600mm diameter
Plant identification	- stain cab	Process operation	spraying patina stain, waterborne stain, basecoat

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/m3	Comments
left 0.15D	8.3	6.3	297	88.4	260	1638	53.9	patina stain, basecoat
left 0.85D								
right 0.15D	8.7	6.6	433	8.0	120	792	10.1	waterborne stain
right 0.85D								

Particulate Matter Stack Monitoring

Stack Identification/Position	- 6	Stack dimensions	550mm diameter
Plant identification	- lacquer cab	Process operation	spraying lacquer

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/m3	Comments
left 0.15D	16.5	12.5	308	0.6	30	375	1.6	
left 0.85D	15.6	11.7	86	1	120	1404	0.7	
right 0.15D	17.9	13.5	461	1.4	120	1620	0.9	
right 0.85D	13.9	10.5	148	0.8	120	1260	0.6	

Pre-monitoring information

Company Burbidge & Son Ltd

Address Awson Street
Coventry

Contact Mr J Gwilliam

Monitoring Emissions from spray booths and automatic spray line to be tested for particulates and volatile organic compounds to comply with City of Coventry Environmental Protection Act 1990 Authorisation Number 045. Monitoring locations shown on enclosed drawing. All locations are internal and accessible from a short ladder run to minimise health & safety risk.

Contractor Mike Thomas BSc MSc
1a Astwick Road
Stotfold
Hitchin
Herts SG5 4AP

affilliated to IEMA

Laboratory Mountainheath Services Ltd
Unit N, Gunnels Wood Park
Gunnels wood Road
Stevenage
Herts SG1 2BH

ukas accredation

Date/time Provisionally set for Tuesday 28th November, all day.

Enclosures Measurement of airflow
Measurement of particulate matter
Measurement of volatile organic compounds
Location drawing

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 of linear flow. BS 3405 states specific minimum distances, in terms of stack diameters, from points of turbulence e.g. fan (3), junction (2) or bend (1). It also states 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.

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 BS 3405. In situations where the airflow is not linear, preference is given to measuring air velocity at the points where sampling will occur.

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 15-30 minute period at points specified in BS 3405. 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. Measurement are taken without correction for water vapour content.

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

Stack Sampling Protocol- Measurement of Volatile Organic Compounds

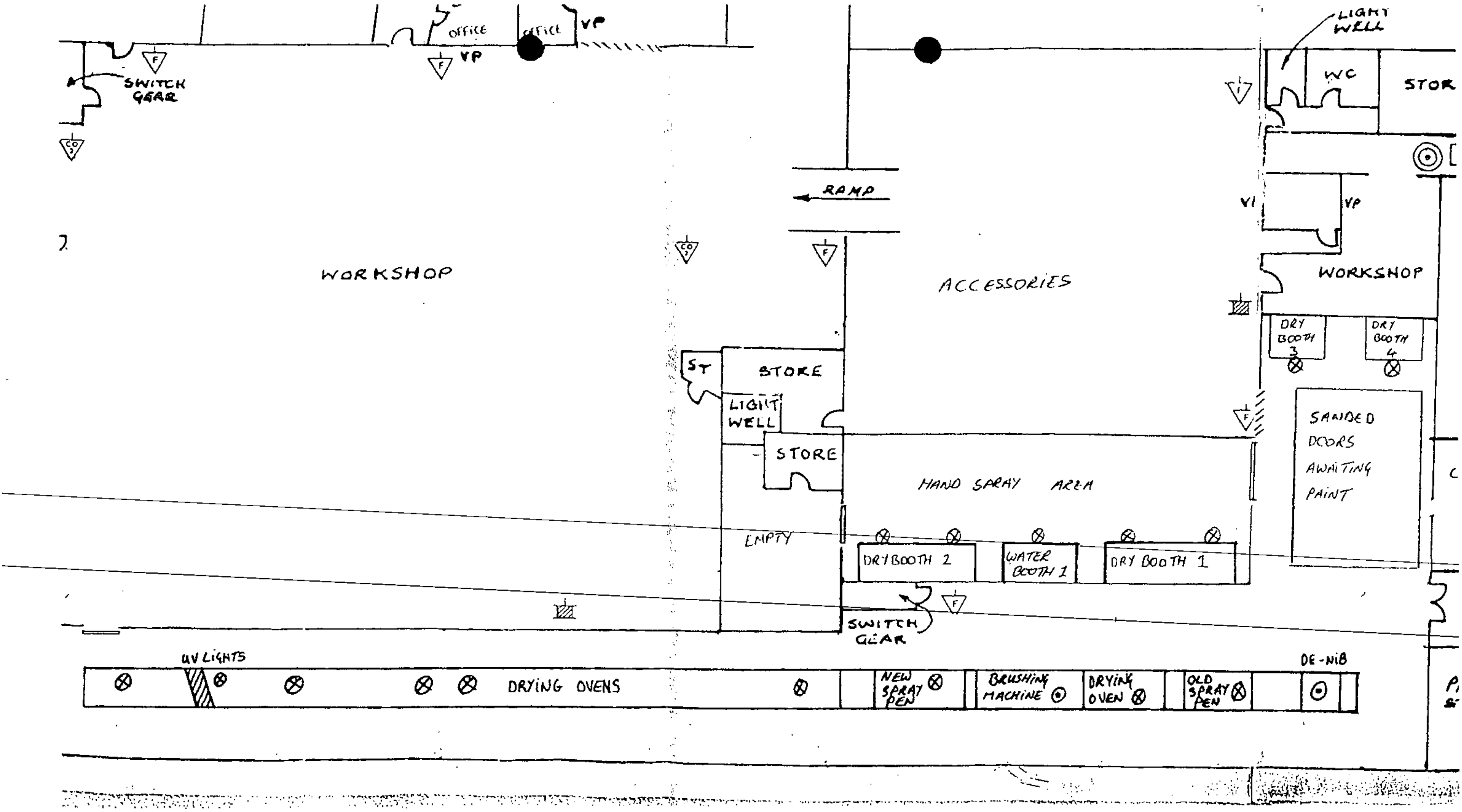
1. Measurements and Analysis
   The quantity of VOC's in a stack is measured by collecting a sample on a charcoal adsorption tube. This sample is subsequently analysed by a combination of Gas Chromatography and Mass Spectroscopy and the weight of VOC's calculated as total carbon.

2. Sampling
   A 6mm stainless steel probe is inserted into the stack and connected to the charcoal adsorption tube. The flue gasses are pumped through the adsorption tube for 20-50 minutes at a rate of 100-200 ml/min.

3. Presentation of results
   The volume of air sampled is derived from the sampling flow rate and the sampling time. The volume is expressed in cubic metres.

   The GC-MS analysis of the flue gasses and subsequent calculation gives the weight of VOC's in total carbon.

   The concentration of volatile organic compounds is expressed as milligrams per cubic metre or $mg.m^{-3}$.


SWITCH GEAR
OFFICE
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WORKSHOP
RAMP
ACCESSORIES
LIGHT WELL
WC
STOR
VI
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WORKSHOP
DRY BOOTH 3
DRY BOOTH 4
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EMPTY
HAND SPRAY AREA
DRYBOOTH 2
WATER BOOTH 1
DRY BOOTH 1
SWITCH GEAR
UV LIGHTS
DRYING OVENS
NEW SPRAY PEN
BRUSHING MACHINE
DRYING OVEN
OLD SPRAY PEN
DE-NIB