



MACHINERY NOISE ASSESSMENT

Air Serv
May 2021

THE WORKSAFE EXPERTS

This report has been compiled by EEUK Ltd by the following competent consultant:

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A handwritten signature in black ink, appearing to read 'G. Zelenovic'.

Signature:

Date: 4th June 2021

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Date: 4th June 2021

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Equipment and Strategy

EEUK Group Ltd was commissioned by Air Serv to undertake an assessment of sound pressure level of the various mechanical units and at their premises in Ashton-In-Makerfield which was conducted on 19th May 2021.

All equipment was calibrated immediately prior to use and upon completion of the survey. No variation in calibration signal was observed.

Casella CEL calibrated the above equipment and copies of the calibration certificates are presented in Appendix B.

Measurements were made using the following equipment:

- CEL 633C Sound Level Meter (serial number 2670877)
- CEL 120/1 Acoustic Calibrator (serial number 3574311)

Static, fixed position and machine noise level measurements were taken with a sound level meter at approximately 1.6m high and in the case of machine noise measurements at 1m from the surface of the machine. Measurements were taken over a period of between one and five minutes where practical.

Noise Assessment

Here presents the sound pressure levels of the various mechanical units measured and corresponding octave band level data can be found in Appendix A.

Measurements			
Monitoring Location	L _{Aeq} (dB)	L _{CPK} (dB)	L _{Ceq} (dB)
Combi - Air Mode	64	100	80
Combi - Vacuum Mode	66	104	76
Combi - Fragrance Mode	61	98	75
Jet Washer - Foaming Lance	65	97	78
Jet Washer - Cold Pre-wash	65	92	74
Jet Washer - Hot Foam Brush	65	92	78
Jet Washer - Cold Wax Gloss	72	92	74
Jet Washer - Cold Rinser	71	101	81
Jet Washer - Air Blaster	77	100	79
Jet Washer - End of Programme Noise	67	94	76
Air Vacuum - Fragrance Mode	69	101	77
Air Vacuum - End of Programme Noise	79	98	79
Air and Screen	74	103	78

Glossary of Terms

A-weighting

A frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive at all frequencies; it consists of an electronic filter in a Sound Level Meter (SLM), which attempts to build this variability into the measured noise level reading so that it will correlate, approximately, with the human hearing (defined in BS EN ISO 61672-1). Measurements are usually displayed as dB(A), or L_{Aeq} for sound pressure levels.

C-weighting

This is a standard frequency weighting for Sound Level Meters and corresponds to the 100 Phon (perceived loudness) equal loudness contour. It is the closest to a linear or unweighted sound level value, with a relatively flat response between 63Hz and 4kHz. It is commonly used for high level noise measurements, peak sound pressure levels and correlates better with the human response to high noise levels at low frequencies (as defined in BS EN ISO 61672-1). C-weighting is used in the Control of Noise at Work Regulations 2005 for peak sound pressure measurements and are typically displayed as dB(C) or L_{Ceq} and L_{CPeak} .

Decibel (dB)

The decibel is the main unit of measuring sound intensities commonly used in acoustics and is an expression of a ratio between two quantities expressed in logarithmic (log) form. It is a numbering scale used to compress a large range of values into a more manageable smaller scale. In scientific terms, the decibel is a unit for expressing the ratio of two powers (electric or acoustic) equal to 1/10 (deci) of a Bel. The threshold of hearing is 0dB and the threshold of pain is approximately 130dB dependent on frequency. In practical terms these limits are seldom experienced and typical levels lie within the range of 30dB (a quiet night-time level in a bedroom) to 80dB (at the kerbside of a busy city street).

Equivalent continuous sound pressure level (A-weighted) L_{Aeq}

This is the continuous equivalent noise level of a time varying noise; the steady noise level (usually in dBA) which, over the measurement period, contains the same amount of (A-weighted) sound energy as the time varying noise over the same period; also called time averaged sound level.

Frequency, Hertz (Hz)

Sound pressure is only part of the description; sound also varies in frequency and over time. Frequency is measured in Hertz (Hz) which is defined as cycles per second. The audible range for the human ear is roughly 20Hz to 20,000Hz or 20kHz, although this varies from person to person. Most audible sounds are detectable between 50Hz and 12kHz. Although, for the purpose of noise at work assessments we are mainly interested in the frequency ranged between 63Hz and 8kHz, as standardised.

Pascals (Pa)

A unit of pressure equal to one Newton per square metre ($1N/m^2$). In the measurement of sound, we are concerned with the amplitude of the acoustic pressure measured in Pa.

Sound level meter (SLM)

An instrument for measuring sound pressure levels.

Sound intensity

The sound power flowing per unit area (in a given direction) measured over an area perpendicular to the direction of flow. The units are W/m^2 .

Sound intensity level, L_I

A sound intensity measured on a decibel scale: $L_I = 10\text{Log}_{10}(I / I_0)$, where I_0 is the reference value of sound intensity, $10^{-12}\text{W}/\text{m}^2$.

Sound power

The sound energy radiated in all directions per unit time by a sound source and measured in watts (W) or joules per second.

Sound power level, L_w

The sound power measured on a decibel scale: $L_w = 10\text{Log}_{10}(W / W_0)$, where W_0 is the reference value of sound power, 10^{-12}W .

Sound pressure

Sound pressure is the air pressure deviation from the local ambient pressure caused by a sound wave. The unit for sound pressure is the pascal (Pa). $1\text{ Pa} = 1\text{N} / \text{m}^2$ (Newtons/ square meter).

Sound pressure level L_p

Sound pressure level is a logarithmic measured of the root mean square (rms) sound pressure represented on the decibel scale relative to the reference sound pressure. The reference sound pressure (p_0), also known as the threshold of human hearing, is $2 \times 10^{-5}\text{Pa}$ and a level of 0dB. This is indicated by the equation: $L_p = 20\text{Log}_{10}(p / p_0)$.

Appendix A – Noise Measurements Including Octave Band Analysis

Operation/Location	L _{Aeq} (dB)	L _{CPK} (dB)	L _{Ceq} (dB)	Frequency, L _{zeq} (dB)							
				63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz
Combi - Air Mode	64	100	80	76.1	69.3	64.4	60.3	53.3	50.2	55.2	58.5
Combi - Vacuum Mode	66	104	76	70.8	65.4	61.2	60.6	57.2	58.3	57.5	59.8
Combi - Fragrance Mode	61	98	75	69.8	67.5	60.1	56.4	52.2	47.5	51.1	56.5
Jet Washer - Foaming Lance	65	97	78	72.9	75.2	62.4	57.9	53.5	54.4	60.2	49.8
Jet Washer - Cold Pre-wash	65	92	74	62.5	72.1	63.3	60.1	58.2	55.5	56.3	56.6
Jet Washer - Hot Foam Brush	65	92	78	71.0	76.2	65.1	63.1	58.2	55.6	50.5	46.2
Jet Washer - Cold Wax Gloss	72	92	74	64.3	66.9	68.6	63.5	62.1	63.9	66.7	64.5
Jet Washer - Cold Rinser	71	101	81	75.5	70.8	66.4	65.0	61.4	62.6	64.8	62.4
Jet Washer - Air Blaster	77	100	79	72.2	65.7	61.7	66.7	68.2	72.2	70.7	70.1
Jet Washer - End of Program Noise	67	94	76	72.2	66.1	62.6	61.5	56.4	59.2	61.9	44.5
Air Vacuum - Fragrance Mode	69	101	77	71.3	66.9	61.8	65.3	65.6	57.4	57.3	58.4
Air Vacuum - End of Program Noise	79	98	79	68.7	64.4	62.5	67.4	62.7	66.4	75.9	58.7
Air and Screen	74	103	78	71.2	74.4	62.8	59.0	60.2	65.3	66.9	71.8

Calibration Certificates

www.casellasolutions.com

CASELLA

Certificate of Conformity and Calibration

Instrument Model:- CEL-613B
Serial Number 2673877
Firmware revision V005-05
Microphone Type:- CEL-251
Serial Number 2185
Preamplifier Type:- CEL-495
Serial Number 003612
Instrument Class/Type:- 1

Applicable standards:-

IEC 61672:2002 / IEC 61671 (Electroacoustics - Sound Level Meters)
 IEC 60621:1979 (Sound Level Meters), ANSI S1.4:1982 (Specifications For Sound Level Meters)

Note:- The test sequences performed in this report are in accordance with the current sound level meter standard - IEC 61672. The combination of tests performed are considered to confirm the products which demonstrate performance to an acceptable standard exceeding referenced Sound Level Meter Standards - IEC 60621 and IEC 61671.

Test Conditions:- 23 °C Test Engineer:- Steps: Adams
 32.6 dB(A) Date of Issue:- November 27, 2020
 1912.7 mbar

Declaration of conformity:-

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications. Tests are performed using equipment traceable to national standards in accordance with Casella's ISO 9001:2008 quality procedures. This product is certified as being compliant to the requirements of the CE Directive.

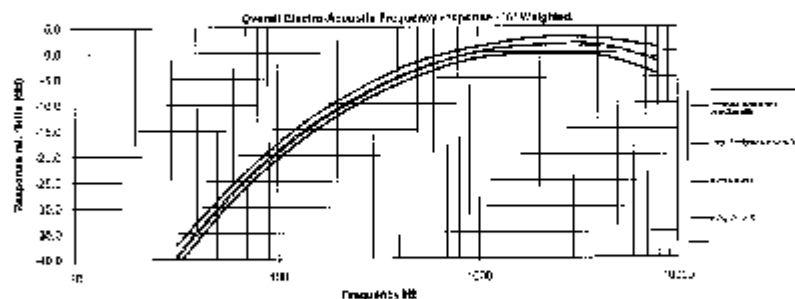
Test Summary:-

Self Generated Noise Test	All Tests Pass
Electrical Signal Test Of Test Frequency Weighting	All Tests Pass
Frequency & Time Weightings At 1 kHz	All Tests Pass
Level Linearity On the Reference Level Range	All Tests Pass
Frequency Response Test	All Tests Pass
Combined Sound Levels	All Tests Pass
Overload Indication	All Tests Pass
Acoustic Tests	All Tests Pass

Combined Electro-Acoustic Frequency Response - A Weighted

Combined Electro-Acoustic Frequency Response - A Weighted (IEC 61672-2:2011)

The following A-Weighted frequency response graph shows this instrument's overall frequency response based upon the application of multi-frequency pressure field calibrators. The microphone Pressure to RMS field calibrator coefficients are applied to pressure response. Reference level taken at 1kHz.



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Operations Manager Casella UK Ltd 10000000 10000000 10000000	Operations Manager Casella USA Ltd 10000000 10000000 10000000	Operations Manager Casella India Ltd 10000000 10000000 10000000	Operations Manager Casella China Ltd 10000000 10000000 10000000	Operations Manager Casella Australia Ltd 10000000 10000000 10000000

Tested to CE-005, and issued 11/11/2020 at 09:00

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CASELLA

Certificate of Conformity and Calibration

Customer: Environmental Essentials

Instrument: CEL-120/1

Serial Number: 3574311

Job Number: 22502

Date of Issue: 09-Nov-2020

Engineer: C Cheaney

Traceable Equipment: Reference Calibrator EQ11084
DVM type Fluke 45 EQ00023

Test Conditions:

Ambient Temperature 24.0 °C
Ambient Humidity 40.0 %RH
Ambient Pressure 1014 mBar

Results:

	Level 1	Level 2	Frequency
Initial Reading	114.14 dB	94.06 dB	1.0000 kHz
Final Reading	114.00 dB	94.00 dB	1.0000 kHz

Uncertainty:

Level ± 0.15 dB
Frequency ± 0.5 Hz

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications.

Tests are performed using equipment traceable to national standards in accordance with Casella's ISO 9000:2015 quality procedures.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

This certificate may not be reproduced other than in full, except with prior written approval of the issuing laboratory.

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Qualifications



University of Salford

This is to certify that

Georgije Zelenovic

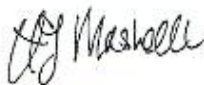
has been awarded the degree of

Master of Science

in

Environmental Acoustics

With Merit



Vice-Chancellor



Registrar

11 November 2019

