WORKPLACE NOISE ASSESSMENT

Celsa Manufacturing UK Ltd
29th April 2021 & 29th July 2021

THE WORKSAFE EXPERTS

This report has been compiled by EEUK Group by the following consultant:

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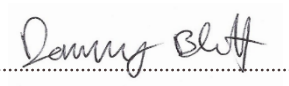
Signature: 

Date: 1st October 2021

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Contents

Executive Summary

EEUK Group Ltd was commissioned by Celsa Manufacturing to undertake an assessment of personal noise exposure and a workplace noise survey at their premises in Cardiff. This was conducted as follows:

- Section Mill. Carried out on the 29th of April 2021 and the 29th of July 2021. Undertaking 3 doseBadge measurements and 35 background SPL readings.

The site is a steel reinforcement materials manufacturer. Personnel could be exposed to workplace noise from various fixed and mobile machinery and tools throughout the facility. The visit was conducted by Danny Bhatt BSc (Hons), MSc, AMIOA, AFOH and Paul Sneddon of EEUK Group's Ltd Occupational Hygiene department. Conditions on the day of monitoring were typical and operating as usual.

Please note, as per The Control of Noise at Work regulation 6 part 1, the employer must ensure that noise is eliminated at source or, where this is not reasonably practicable, reduced to as low a level as is reasonably practicable (ALARP).

Summary of Results and Key Observations:

The personal exposure monitoring results did not exceed the upper exposure action value (UEAV) of 85 dB(A) Lep'd.

The results of personal exposure monitoring indicated that the personal noise exposure levels were at or above the lower exposure action value (LEAV) of 80 dB(A) Lep'd for 2 of the 3 employees monitored.

At this level, the employer must conduct a suitable and sufficient risk assessment of noise. Employees must be given information, instruction and training so that they may understand the risks and how to properly use the controls provided. Health surveillance may be necessary (If there Is evidence that their employees' hearing is at risk) and must be provided for those at particular risk e.g. a family history of deafness.

The remaining 1 worker (crane driver) showed personal daily exposure levels below the LEAV.

Background readings, taken at static locations throughout the workplace, showed the following results which exceeded 85 dB(A) :

- By recouporator at back of furnace
- By steps and fire exit. Sub-station. Charging bogie drive
- By furnace skids
- By furnace. Fan noise, low frequency. Periodic air release.
- Boogking line walkway - bar passing
- By stand 0
- By control plan. Rooghing. Clarkson sounded
- Outside CP1. Bar pass/drop.
- Pomini by stand 10. Approx. 5m distance away.
- Pomini control station.
- Divide shears.
- South end of cooling bay. Machine noise and motor noise constant and banging.
- Blad building area. Banging in the distance.
- Short extraction. Burning/cutting.
- Short extraction. No cutting.
- Cold shears. By cage. Outside CP.
- Stacker. By rotating magnet profiles station 7.
- Outside CP3 at Stacker.

- Roll shop. Tacchi lathe. At control panel.
- Roll shop. Impact gun.
- Roll shop. Grinder.
- Roll shop. Pneumatic impact gun.
- Roll shop. In roll shop. While shearing by fire exit and wall to mill.

At these levels, hearing protection should be mandatory (where noise exposure cannot be reduced by other means) and mandatory hearing protection zones designated In these areas / at these processes.

Background readings, taken at static locations throughout the workplace, showed the following results which exceeded 80 dB(A):

- By control plan. Rooghing. Clarkson not sounding.
- By CP1 - no bars. At front of CP.
- Roll shop. Geminis cathe. Finishing cot.
- Roll shop. Herkules lathe. At control panel.
- Roll shop. In roll shop while shearing on walkway by Tocchi lathe. 70/bangle.

At these levels, hearing protection should be made available to employees upon request and advisory hearing protection zones designated In these areas / at these processes.

The hearing protection analysis of the hearing protection devices (HPDs) in use (see Appendix C, those HPDs available on site are underlined) showed that these are mostly not able to provide employees with suitable hearing protection against those noise levels Identified on site. Alternative HPDs should be sourced. The hearing protection analysis (shown in Appendix C) also shows of a selection of a few other popular hearing protection devices (HPDs). These also showed that these are not able to provide employees with suitable hearing protection against those noise levels Identified on site

Summary of Recommendations:

The personal dosimetry and short-term measurements taken indicate that the noise levels employees are exposed to have the potential to cause noise induced hearing loss from prolonged exposure without adequate noise control, therefore, the following noise control solutions should be applied:

- Implement a 'buy quiet' policy, if this is not already in place, to ensure any new machinery/tools are purchased under this policy.
- Continue to restrict access to the lines, other than during periods of maintenance work and when HPDs are worn.
- While the lines are in operation time spent in this area should be kept to a minimum.
- Consider rotation of employees.
- Inspect the Control Cabin doors to ensure the seal is adequate to minimise noise intrusions. Consider constructing noise refuges for other areas of the site which could benefit from a noise isolation enclosure.
- Tools and equipment should be kept In good working order via a maintenance programme, If this is not already in place. Any perishable components such as bearings and rollers should be replaced when required.
- Ensure information, instruction and training alongside supervision are undertaken to ensure machinery is used and products are handled under best practice and any faults with said machinery is reported to the correct person.
- Based on the results of this survey, it is advised that the current HPZs should remain in place.
- Reinforce training with regards to the requirements for employees to use hearing protection.
- Ensure that employees understand the risks associated with noise exposure by providing noise awareness training.
- It is recommended that the employer seek suitable HPD options for these noise levels present on site. The HSE provide a hearing protection spreadsheet which aids in this calculation. The frequencies data shown in Appendix A can be applied under the octave band calculator In this HSE spreadsheet.
  - https://www.hse.gov.uk/noise/calculator.htm
- Ensure all floor surfaces are in good condition to prevent noise from oscillation of the forks on the forklift trucks.

Introduction

Research estimates that over 2 million people in the United Kingdom are exposed to noise levels at work that may be harmful.

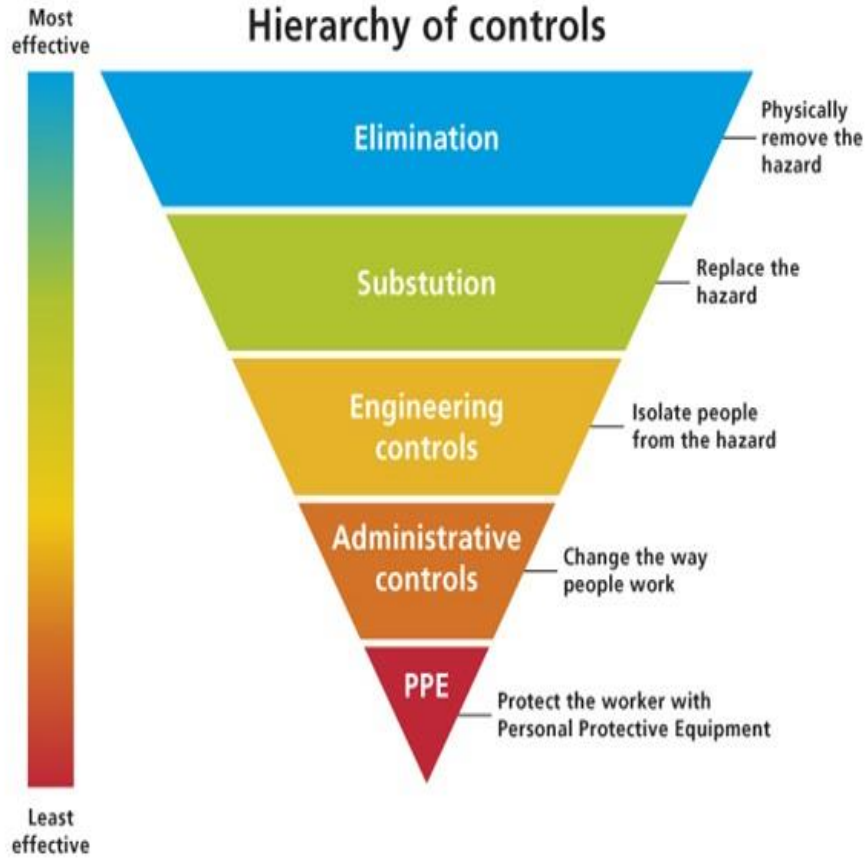
Hearing damage caused by noise exposure is permanent and incurable. Therefore, the prevention of noise induced hearing loss (NIHL) from exposure at work is essential. Impact or impulsive noise can cause *acoustic trauma* and can result in permanent hearing damage. However, it is damage to the little hair-cells (stereocilia), that send electrochemical signals to the hearing part of the brain from the inner-ear (cochlea), that is caused through constant exposure to excessive noise that results in most cases of work-related hearing loss. Noise induced hearing loss manifests itself initially in the difficulty of hearing high frequencies, particularly around the frequency band of 4kHz, then following the progressive impairment of hearing.

Fundamentally, sound is vibrations of air molecules that is detectable by the ear. Sound waves are small fluctuations in air pressure that radiate from a sound source and vary in frequency (pitch or tone) and amplitude (intensity or volume) over time: in simple terms, the sound source is a point in space. *Noise* is sound that is unwanted, unpleasant or disturbing and it is possible for a sound that one person thinks is desirable (e.g. music) to be considered as noise by another person. It is particularly true when noise has radiated or been transmitted into spaces where it was not intended to be or welcome. Acousticians regularly interchange the terms *sound* and *noise,* specifically when they refer to *noise levels*, a *noise survey* or *noise readings*. Strictly speaking *noise*, as referred to in this report, is in fact sound pressure levels because that is what is being measured and recorded.

The Control of Noise at Work Regulations 2005 (the Noise Regulations), that came into force on 6 April 2006, are based on a European Union Directive and came about as a result of several years of deliberations and consultations. The Noise Regulations require employers to protect workers from the risks caused by noise, and to reduce noise in the workplace to as low as reasonably practicable (ALARP) or at least below the action values.

Scope of Survey:	The objectives of the survey were: – to assess the noise exposure prevention and control measures currently in place and make recommendations for improvements where necessary. – to assess the suitability of the current hearing protection provided against the elevated noise present on site, via the octave band analysis method. – to identify whether employees are exposed to noise at or above the exposure action values and, In case of extreme noise levels, above the exposure limit value (with HPD attenuation taken into account). – to identify areas and/or machines which give rise to noise levels at or above the peak sound pressure levels and to identify areas of elevated background noise levels (Leq). – to take into account the requirements of The Control of Noise at Work Regulations 2005.
Hours of work for the shift monitored was as follows:	– 06:00 to 18:00, with breaks totalling 45 minutes – 05:00 to 17:00, with breaks totalling 45 minutes
Limitations / Exclusions:	– None
Any special Client instructions:	– None

Exposure Criteria			
Action / Limit Value	dB(A)	dB(C)	Requirement
In all cases	-		The employer must ensure that noise is eliminated at source or, where this is not reasonably practicable, reduced to as low a level as is reasonably practicable (ALARP), as per regulation 6 part 1.
Lower	80	135	In addition to reducing noise to ALARP- The employer must conduct a suitable and sufficient risk assessment of noise Hearing protection should be made available to employees upon request Employees must be given information, instruction and training so that they may understand the risks and how to properly use the controls provided Health surveillance must be provided for those at particular risk e.g. a family history of deafness.
Upper	85	137	In addition to the above actions- Noise exposure must be further reduced by implementing organizational and technical control measures Health surveillance is likely to be required (as at the UEAV there is likely a risk to health) Hearing protection should be mandatory (where noise exposure cannot be reduced by other means) and hearing protection zones designated

Limit	87	140	This limit takes into account the attenuation provided by hearing protection worn. This limit must not be exceeded under any circumstances. It is a legal and enforceable limit. All above listed actions must also be taken at this level.
Key Regulation	– Regulation 4 Exposure limit values and action values – Regulation 5 Assessment of the risk to health and safety created by exposure to noise at the workplace – Regulation 6 Elimination or control of exposure to noise – Regulation 7 Hearing Protection – Regulation 8 Maintenance and use of equipment – Regulation 9 Health Surveillance – Regulation 10 Information, instruction, and training		
Noise Reduction	Regulation 6 of the Control of Noise at Work Regulations 2005 places a duty on the employer to take action to eliminate the risks from noise exposure completely wherever it is reasonably practicable to do so. This can be achieved by implementing the hierarchy of control.  	

Equipment and Strategy

The noise measurements were carried out in accordance with HSE guidance set out in the document *L108 Controlling Noise at Work* published in 2005.

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 D.

Measurements were made using the following equipment:	– CEL 633C Sound Level Meter (serial number 0873616) – CEL 110/1 Acoustic Calibrator (serial number 5230578) – CEL 350 dBadge Personal Noise Exposure Meters (serial numbers 5044119, 1056582, 5044601 & 0556337, 2105873, 2105814, 2105818,2105945)

The duration that individuals are exposed to specific noise levels for is determined as accurately as possible. Where an individual is likely to be exposed to more than one level of noise at different times during the shift, this is taken into account when calculating average daily exposure.

Where the noise exposure of a person is variable over time and measurement of their noise exposure difficult with a sound level meter, to provide further information on average noise levels, personal dosimetry has been used. A personal noise exposure meter is fixed to the individual with the microphone in a position near to the ear and it is then run for a period considered representative of the activity under consideration. There are errors associated with the use of personal noise dosimetry which are documented in Health and Safety Executive guidance document *L108 Controlling Noise at Work*. These errors are associated mainly with possible reflections from the clothing, and the positioning of the microphone in relation to major noise sources. Therefore, interpretation of information from this source of monitoring takes into account any possible inaccuracies when making a final assessment.

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 at the operator's position. Measurements were taken over a period of between one and five minutes where practical. Areas or processes producing levels of noise greater than 85dB(A) were subject to octave band analysis to provide a breakdown of the frequency components for use in the selection of adequate noise control.

Personal noise dosimetry was carried out on employees selected as being most likely to be:	– exposed to the highest levels of noise within their normal working pattern – exposed to highly variable noise levels
A representative of the Client selected the following employees in conjunction with EEUK Group Ltd during the assessment:	– Keith Gunstone – Remis Vaskevicius – Michael Farmer

Noise Assessment

Operation/Location	**Section Mill**
Observations	
The lines running throughout section mill were largely automated with the operatives having to go onto the lines mainly for maintenance purposes. Otherwise, distance was kept between the workers and the line. The noise source was mainly from the mechanics of this line. The noise was constant. The CP were fully enclosed control rooms with between one and two operatives manning the lines. Mandatory hearing protection zones (HPZs) were displayed around the lines.	

Operational conditions:	The noise levels measured were reported to be representative of normal operational conditions.			
Personal Dosimetry Sampling times:	Areas where employees work that were considered to produce a constant noise environment were measured for at least one hour and areas where employees work that were considered to produce a variable and/or intermittent noise environment were measured for a longer representative sample time.			
Who is likely to be affected?	Section Mill production staff			
Others at risk?	People who are not employees	Trainees	Self-employed	Visitors
Current control measures:	– Acoustics insulated control room. – Hearing protection – Area restrictions – Warning signage			
Health Surveillance:	In place annually			

Discussion of Results
The results of personal exposure monitoring Indicated that the personal noise exposure levels were at or above the lower exposure action value (LEAV) of 80 dB(A) Lep'd for 2 of the 3 employees monitored. The results are summarised as follows: – Keith Gunstone, Roll shop operative, 12hr shift, 84.0 dB(A) Lep'd – Remis Vaskevicius, Billet Bank West End operative, 12hr shift, 80.5 dB(A) Lep'd At this level, the employer must conduct a suitable and sufficient risk assessment of noise. Employees must be given information, instruction and training so that they may understand the risks and how to properly use the controls provided. Health surveillance may be necessary (If there is evidence that their employees' hearing Is at risk) and must be provided for those at particular risk e.g. a family history of deafness.

The remaining 1 worker showed personal daily exposure levels below the LEAV.

Please note that these background results (listed in Appendix A) are being compared to the 80 dB(A) and 85 dB(A) levels for indicative purposes only. Exceeding these levels for a short period may not actually result In a calculated daily exposure level (Lepd) exceeding the LEAV or UEAV. The duration of exposure must also be taken into account. Therefore, these SPL results from background readings are provided as a means to help identify the high noise and low noise areas of the site and thus better focus the duty holder's decisions re exposure controls where needed.

The short-term measurements indicate that noise levels exceeded 85 dB(A) as follows:

- By recooporator at back of furnace
- By steps and fire exit. Sub-station. Charging boggie drive
- By furnace skids
- By furnace. Fan noise, low frequency. Periodic air release.
- Boogking line walkway - bar passing
- By stand 0
- By control plan. Rooghing. Clarkson sounded
- Outside CP1. Bar pass/drop.
- Pomini by stand 10. Approx. 5m distance away.
- Pomini control station.
- Devide shears.
- South end of cooling bay. Machine noise and motor noise constant and banging.
- Blad building area. Banging in the distance.
- Short extraction. Burning/cutting.
- Short extraction. No cutting.
- Cold shears. By cage. Outside CP.
- Stacker. By rotating magnet profiles station 7.
- Outside CP3 at Stacker.
- Roll shop. Tacchi lathe. At control panel.
- Roll shop. Impact gun.
- Roll shop. Grinder.
- Roll shop. Pneumatic impact gun.
- Roll shop. In roll shop. While shearing by fire exit and wall to mill.

The short-term measurements indicate that noise levels exceeded 80 dB(A) as follows:

- By control plan. Rooghing. Clarkson not sounding.
- By CP1 - no bars. At front of CP.
- Roll shop. Geminis cathe. Finishing cot.
- Roll shop. Herkules lathe. At control panel.
- Roll shop. In roll shop while shearing on walkway by Tocchi lathe. 70/bangle.

Conclusions

The personal dosimetry and short-term measurements taken indicate that the noise levels employees are exposed to have the potential to cause noise induced hearing loss from prolonged exposure and acoustic trauma from exposure to peak noise levels without adequate noise control.

Specific Recommendations	
EEUK Group Ltd recommends that to control levels of workplace noise and to reduce personal exposure the following noise control solutions are applied:	
1	Implement a 'buy quiet' policy, if this is not already in place, to ensure any new machinery/tools are purchased under this policy.
2	Continue to restrict access to the lines, other than during periods of maintenance work and when HPDs are worn.
3	While the lines are in operation time spent in this area should be kept to a minimum.
4	Consider rotation of employees.
5	Inspect the Control Cabin doors to ensure the seal is adequate to minimise noise intrusions. Consider constructing noise refuges for other areas of the site which could benefit from a noise isolation enclosure.
6	Tools and equipment should be kept In good working order via a maintenance programme, If this Is not already In place. Any perishable components such as bearings and rollers should be replaced when required.
7	Ensure information, instruction and training alongside supervision are undertaken to ensure machinery is used and products are handled under best practice and any faults with said machinery is reported to the correct person.
8	Based on the results of this survey, it is advised that the current HPZs should remain in place.
9	Reinforce training with regards to the requirements for employees to use hearing protection. Ensure that employees understand the risks associated with noise exposure by providing noise awareness training.
10	It is recommended that the employer seek suitable HPD options for these noise levels present on site. The HSE provide a hearing protection spreadsheet which aids In this calculation. The frequencies data shown In Appendix A can be applied under the octave band calculator In this HSE spreadsheet. https://www.hse.gov.uk/noise/calculator.htm
11	Ensure all floor surfaces are in good condition to prevent oscillation of the forks on the forklift trucks.

General Recommendations

Regulation 6 of the Control of Noise at Work Regulations 2005 places a duty on the employer to take action to eliminate the risks from noise exposure completely wherever it is reasonably practicable to do so. If it is not reasonably practicable to eliminate the risks completely, to reduce them to as low a level as is reasonably practicable and to introduce a formal programme of organisational and technical measures to reduce noise exposure whenever an employee's exposure to noise is likely to exceed the upper exposure action values (these measures cannot include hearing protection). There is also a legal requirement not to expose any employees above the exposure limit values.

Further detailed guidance is given on the action required to comply with the Control of Noise at Work Regulations 2005 and how to protect employee's health with respect to noise in the workplace.

Controlling the noise at source:

- Modify the source
- Redesign the source
- Relocate the source

Controlling the noise at the transmission pathway:

- Enclosure of the source
- Absorption material on walls and ceilings to reduce the indirect sound transmission pathway
- Barrier between the source and receiver to reduce the direct sound transmission pathway

Controlling the noise at the receiver:

- Enclosure or noise refuge for the employee
- Absorption material on walls and ceilings to reduce the indirect sound transmission pathway
- Relocate the employee further away from the noise source

Information, Instruction and Training

It is important that employees understand the risks they may be exposed to and where they are exposed to noise equal to or exceeding the Lower Exposure Action Value of 80dB(A), employees should be informed of:

- the likely noise exposure and the risk to hearing this noise creates
- what their employer is doing to control risks and exposures
- where and how people can obtain hearing protection
- how to report defects in hearing protection and noise-control equipment
- what their duties are under the Control of Noise Regulations 2005

- what they should do to minimise the risk, such as the proper way to use hearing protection and other noise-control equipment, how to look after it and store it, and where to use it; and

- the health surveillance systems.

The Client should ensure that all employees have received a form of noise awareness training and are aware of the damage to hearing that can be caused through exposure to noise levels. All personnel should be made aware of the noise levels they are exposed to – especially those who took part in the assessment for personal dosimetry. (Regulation 10 of the Control of Noise at Work Regulations 2005).

This information should be given in a way the employee can be expected to understand (for example special arrangements might need to be made if the employee does not understand or read English). To establish whether information, instruction and training has been carried out effectively, look for evidence: that personal hearing protection is being properly used, that noise control equipment is being used and that procedures for low noise working are being followed.

The Client should ensure that any training given is recorded on the employee's individual training record and ensure that all new starters receive noise awareness training as part of their induction programme.

Purchasing

Introducing a positive purchasing and hire policy can be the most cost-effective long-term measure you take to reduce noise at work. Choosing quieter equipment and machinery, whether it is bought or hired, from the start can save you the cost of introducing noise-reduction measures once it is installed or in use.

You could do the following:

- Consider at an early stage how new or replacement machinery could reduce noise levels in the workplace - set a target to reduce the noise levels if possible.

- Ensure you specify a realistic noise output level for all new machinery and check that tenderers and suppliers are aware of their legal duties.

- Ask the suppliers about the likely noise levels under the particular conditions in which you will operate the machinery, as well as under standard test conditions. If you ask the same question to all suppliers, you can compare information. Noise output data will only ever be a guide as many factors affect the noise levels experienced by employees, but it will help you to buy quieter machines.

- Try to purchase or hire only from suppliers who can demonstrate a low-noise design, with noise control as a standard part of the machine, not as a costly optional extra.

- Keep a record of your decision process, to help show that you have met your legal duties to reduce workplace noise.

Remember to ask your supplier about:

- Installation arrangements, e.g. methods of mounting and location, to ensure machinery operates as quietly as possible

- Anything about how the machine operates which could affect the noise it produces

- Maintenance arrangements to ensure the machine continues to operate properly and does not get louder over time

Maintenance

Regulation 8 of the Control of Noise at Work Regulations 2005 requires that all tools, equipment, and machinery on site are subjected to a regular scheduled maintenance program to certify safe and efficient operation.

Check with the operator of equipment or machinery that the noise level has not increased over time. If it has, this is an indication that the machine requires attention. Have a reporting system in place so that the operator can inform the appropriate person(s) of problems.

Check that the noise-control features fitted to the machine have not deteriorated or been removed/tampered with.

In many cases, a noise hazard will be created or made worse by lack of maintenance. Parts may become loose, creating more noise because of improper operation, or scraping against other parts. Grinding noises may also occur as the result of inadequate lubrication. It is especially important to provide proper maintenance of noise control devices which are added or built into machinery. Loose or worn parts should be fixed as soon as possible.

Always check and see if there are any problems starting to appear with a machine or equipment. Check for signs of wear or if the machine's performance is down. Some problems will appear as looseness or increased vibration. Listen for new noises, especially tonal "whining" sounds, repeated impacts, or high frequency "screech" sounds. Also, slipping belts will cause a screech at start up, while a damaged bearing may appear as a "clunk" during run down.

Typical examples of why machines get noisier with use:

- Worn or chipped gear teeth - will not mesh properly, the shiny wear marks are often visible on the teeth.
- Worn bearings - bearing wear creates vibration and noise, as flat spots or cracks appear in the balls.
- Slackness between worn or loose parts - causes rattling noises, squealing from slack drive belts, "piston slap" in motors, air leaks, etc.
- Poor lubrication - causes squeaking noises due to friction or impact noise in dry and worn gears or bearings.
- Imbalance in rotating parts - imbalances with fan impellers or motor shaft will show up as excess vibration and noise.
- Obstruction in airways - a build-up of dirt or a bent/damaged piece of metal in an airway or near a moving part, e.g. a bent fan guard, can cause whistling or other turbulent air related noise.
- Blunt blades or cutting faces - blunt or chipped saw teeth, drill bits, router bits etc, usually make the job noisier as well as slower.
- Damaged silencers - silencers for air-driven machines or mufflers for engines may become clogged with dirt, rusted or damaged, so losing their ability to absorb noise.
- Removal of a noise-reducing attachment - mufflers, silencers, covers, guards, vibration isolators etc. which reduce noise should never be removed except during maintenance and then must be replaced immediately.

Health Surveillance/Audiometry

Regulation 9 of the Control of Noise at Work Regulations 2005 requires that the employer provide suitable health surveillance where the risk assessment indicates a risk to workers' health. The results of your health surveillance programme will allow you to identify whether or not the hearing protection in use has prevented hearing damage.

Regulation 6 of the Management of Health and Safety at Work Regulations 1999 requires employers to provide employees with appropriate health surveillance in relation to the risks to health and safety identified by the risk assessment, for example high noise levels.

For employees exposed to noise levels equal to or above the Upper Exposure Action Value of 85dB(A), occupational audiometric assessments should be carried out on an annual basis for the first two years and then three yearly thereafter unless there is cause for concern. The purpose of the assessment is to indicate any potential noise induced hearing loss that may have occurred for employees from exposure to industrial noise. The audiometry will categorise any employees who may have developed hearing loss as follows:

HSE Categorisation scheme

Category	Action
1. ACCEPTABLE HEARING ABILITY Hearing within normal limits	None
2. MILD HEARING IMPAIRMENT May indicate developing NIHL	Warning
3. POOR HEARING Suggests significant NIHL	Referral to medical practitioner
4. RAPID HEARING LOSS Reduction in hearing level of 30 dB or more, within 3 years or less.	Referral to medical practitioner

It is recommended that all new employees undertake an audiometric assessment as part of a baseline health medical prior to commencing employment. A baseline assessment will show any hearing damage that may have occurred during previous employment or social activities.

Hearing Protection

The Client should continue to provide a range of hearing protection as required by Regulation 7 of the Control of Noise at Work Regulations 2005. However, it appears from the calculations showing the effectiveness of the hearing protection provided, that in the majority of instances illustrated, the ear plugs or ear defenders provided overprotect or under-protect the operatives. The Client should ideally aim to supply a range of hearing protection that attenuates noise at the ear to between 70-79dB(A) and avoid protectors resulting in less than 70dB(A) at the ear as this is 'over-protection'.

Over-protection is where the supplied level of hearing protection reduces noise at the ear to below 70dB(A). The effect this has is that the hearing sense is reduced, increasing the risk of workplace accidents from slips, trips, falls and collisions with vehicles. Employees who are overprotected may also experience communication difficulties.

Where noise at the ear is attenuated to a level equal to or exceeding the Lower Exposure Action Value of 80dB(A) EEUK Group Ltd considers this to be under-protection and therefore the selected hearing protection is not an adequate form of noise control to protect all employees against discomfort and the potential for Noise Induced Hearing Loss. This allows an extra 5dB of protection for noise variations and as a factor of safety to ensure that noise at the ear is never equal to or exceeding the Upper Exposure Action Value of 85dB(A).

Ear plugs can be uncomfortable to wear for long periods of time due to the pressure on the ear canal, therefore it is essential that the hearing protection is worn correctly and well maintained. If any employees wear earmuffs for any period of time, it is recommended that they utilise disposable sweat pads to make the wearing of these protectors more comfortable. These encourage hearing protection compliance as a result of consideration to comfort.

Operators need to be fully informed of the dangers of high noise levels, the consequences of Noise Induced Hearing Loss and the benefits of wearing hearing protection.

Hearing protection should be issued to all individuals exposed/requiring hearing protection for their personal use and records should be kept of the maintenance schedule (where applicable) and whether it is carried out. The responsibility of issuing ear defenders should be assumed by local supervision/management and the wearing, where required, enforced. Provision should be made for the safe and hygienic storage of reusable hearing protection.

Employees should be examined medically to ensure that any difficulties or discomfort brought about by wearing hearing protection does not cause harm to their ears.

Employees are responsible for:

- Reporting any defect with hearing protection and obtain a replacement.
- Communicating any problems with hearing protection in terms of comfort and hygiene.
- Informing management immediately of any medical condition preventing the wearing of hearing protection

Review of Assessment

This assessment will need to be kept up to date and an interval of approximately two years should not be exceeded for review even if you believe there have been no changes to the workplace environment. Further noise measurements should be made in order to assess the new conditions with any or a combination of the following:

- If there is any reason to think that the results do not reflect the current noise risk in the workplace. For example, if you change the way you work or the process that you use, bring in new machinery, stop using old machinery or alter shift patterns or if the noise exposures of your employees are likely to change.
- If you become aware of new ways of working or improved noise-control techniques that could be applied to your workplace.
- If you have introduced noise control measures following a previous assessment and need to determine the impact of implemented control measures on employee exposure.
- If health surveillance shows that employees' hearing is being damaged, suggesting that noise risks are not being properly controlled.
- If control measures that could not be justified when you originally conducted your assessment become reasonably practicable, e.g. because of changes in technology or cost.

Assessments must be kept until a new one is undertaken.

References

1. Control of Noise at Work Regulations 2005
2. Health and Safety Executive Guidance Document L108 Controlling Noise at Work.
3. The Control of Noise at Work Regulations 2005. - Guidance on Regulations
4. Health and Safety at Work Act 1974
5. Health and Safety Executive - INDG 362 Noise at Work. Guidance for Employers on the Control of Noise at Work Regulations 2005
6. Health and Safety Executive - HSG 138 Sound Solutions. Techniques to Reduce Noise at Work
7. Management of Health and Safety at Work Regulations 1999
8. The Supply of Machinery (Safety) (Amendment) Regulations 2011
9. The Safety Signs & Signals Regulations 1996

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 liner 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).

Daily personal exposure level, $LEP_{,d}$

This is a steady or constant level which, over 8-hours, contains the same amount of A-weighted sound energy as is received by the subject during the working day (defined in ISO 1999:1990).

Weekly personal exposure level, $LEP_{,w}$

The weekly personal noise exposure level for a nominal week of five working days.

Equivalent continuous sound pressure level (A-weighted) LA_{eq}

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.

Advisory hearing protection zone (AHPZ)

Any area of the workplace where an employee is likely to be exposed to noise at or above the lower exposure action value (80dBA) and below the upper exposure action value (85dBA).

Mandatory hearing protection zone (MHPZ)

Any area of the workplace where an employee is likely to be exposed to noise at or above the upper exposure action value (85dBA).

Meters (m)

A measure of distance in meters.

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.

Single number rating (SNR)

A single number rating system for hearing protectors expressed in dB and used as a guide to compare the potential noise reduction capability. This method requires a C-weighted average sound level measurement (L_{Ceq}) for each 'noise risk' area and the manufacturers SNR figure for the specific protector (as defined in BS EN ISO 4869-2:2018).

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}W/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 Pa = 1N/ 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 2×10^{-5}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

ID	Operation/Location	L_{Aeq} (dB)	L_{CPK} (dB)	L_{Ceq} (dB)	Frequency, L_{Aeq} (dB)							
					63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz
22	By recooporator at back of furnace	85.5	105.0	90.9	59.2	65.9	74.4	82.8	80.3	76.1	70.3	62.6
23	By steps and fire exit. Substation. Charging boggie drive	85.0	106.5	89.0	55.0	64.6	73.5	79.2	80.0	77.7	76.1	71.4
24	By furnace skids	86.1	110.2	90.2	53.8	67.1	75.3	80.9	81.3	79.1	74.3	64.0
25	By furnace. Fan noise, low frequency. Periodic air release.	93.5	111.5	98.7	64.1	71.9	83.6	92.0	85.5	83.8	80.2	74.3
26	Boogking line walkway - bar passing	88.4	117.8	92.2	56.2	67.6	77.1	83.9	83.7	81.2	75.6	65.0
27	By stand 0	86.5	107.6	90.2	53.7	65.6	75.4	82.3	81.3	77.1	74.9	68.5
28	By control plan. Rooghing. Clarkson sounded.	91.0	112.9	94.9	51.0	64.5	76.4	90.3	82.8	81.0	78.0	67.2
29	By control plan. Rooghing. Clarkson not sounding.	84.5	102.6	88.5	51.1	64.4	72.8	81.4	78.5	75.1	70.2	61.2
30	By CP1 - no bars. At front of CP.	84.1	103.0	87.2	50.5	61.8	72.6	77.6	78.6	77.9	76.0	68.3
31	Inside CP1. Radio noise.	68.5	91.3	71.6	-	-	-	-	-	-	-	-
32	Inside CP1. Bar passing.	57.9	86.7	70.0	-	-	-	-	-	-	-	-
33	Outside CP1. Bar pass/drop.	87.9	109.5	90.4	53.7	64.3	73.6	82.4	82.3	82.0	77.8	68.2
34	Pomini by stand 10. Approx. 5m distance away (unsafe to stand closer)	85.6	107.4	89.0	49.6	64.1	74.5	80.9	79.8	78.4	76.0	68.8
35	Pomini control station.	85.1	105.0	88.5	46.6	61.9	75.3	80.0	79.8	77.6	75.5	67.9
36	Devide shears.	88.8	111.4	90.5	49.4	64.4	74.7	80.7	83.3	83.9	80.6	71.8
37	South end of cooling bay. Machine noise and motor noise constant and banging.	87.4	110.4	92.3	58.3	70.5	76.6	82.4	83.0	80.6	73.2	61.5
38	Blad building area. Banging in the distance.	90.1	113.4	90.0	46.3	58.2	68.6	77.0	85.9	86.6	79.3	66.0

39	Short extraction. Burning/cutting.	101.9	123.8	100.9	48.6	63.7	75.2	87.3	94.2	94.3	96.9	96.4
40	Short extraction. No cutting.	96.9	120.0	96.8	50.0	62.8	75.5	83.2	93.1	93.1	87.0	73.0
41	Cold shears. By cage. Outside CP.	101.6	121.2	101.2	53.1	67.3	77.5	86.7	97.8	97.7	92.1	81.1
42	Inside CP2. During cold shearing.	62.8	95.2	69.5	-	-	-	-	-	-	-	-
43	Stacker. By rotating magnet profiles station 7.	92.7	120.9	92.5	48.4	61.7	71.3	79.1	88.3	88.7	83.5	78.9
44	Outside CP3 at Stacker.	89.3	117.0	89.9	49.8	63.9	71.3	77.4	84.0	85.0	81.7	77.3
45	Inside CP3 at Stacker.	61.5	87.3	67.7	-	-	-	-	-	-	-	-
46	Roll shop. Tacchi lathe. At control panel.	85.7	101.8	85.4	47.2	57.4	64.3	71.9	74.8	75.3	81.9	80.5
47	Roll shop. Geminis cathe. Finishing cot.	80.4	99.5	82.2	46.5	58.3	63.1	71.4	72.8	71.6	76.0	72.1
48	Roll shop. Herkules lathe. At control panel.	83.5	98.1	83.9	45.3	57.7	64.0	69.6	78.4	80.0	75.4	68.0
49	Roll shop. Day services workshop. Spacial. Low activity.	53.6	82.1	64.1	-	-	-	-	-	-	-	-
50	Roll shop. E-bay. Burning end- south.	52.9	83.7	66.4	-	-	-	-	-	-	-	-
51	Roll shop. E-bay. North.	50.0	78.4	62.5	-	-	-	-	-	-	-	-
52	Roll shop. Impact gun.	103.8	130.0	102.2	44.4	57.2	71.8	80.6	89.4	97.9	101.1	95.5
53	Roll shop. Grinder.	92.8	107.9	91.1	34.7	53.0	53.3	65.9	78.6	82.7	91.2	85.3
54	Roll shop. Pneumatic impact gun.	101.2	123.8	100.9	51.7	69.9	80.9	90.1	90.8	97.8	95.5	90.3
55	Roll shop. In roll shop while shearing on walkway by Tocchi lathe. (need to know what product). 70/bangle.	82.6	101.3	84.3	47.6	58.4	66.5	71.7	79.5	77.7	69.8	57.6
57	Roll shop. In roll shop. While shearing by fire exit and wall to mill.	86.0	106.3	86.8	47.8	59.8	68.0	72.5	82.8	81.6	74.7	65.5

Regarding the short-term measurements in the tables above, the key to the 'RAG system' is as follows:

Leq (A-weighted) measurement **below 80 dB(A)**
Leq (A-weighted) measurement **equal to or above 80 dB(A)**
Leq (A-weighted) measurement **equal to or above 85 dB(A)**

Peak Sound Pressure Level (C-weighted) measurement **below 135 dB(C)**
Peak Sound Pressure Level (C-weighted) measurement **equal to or above 135 dB(C)**
Peak Sound Pressure Level (C-weighted) measurement **equal to or above 137 dB(C)**

Appendix B – Dosimeter Results

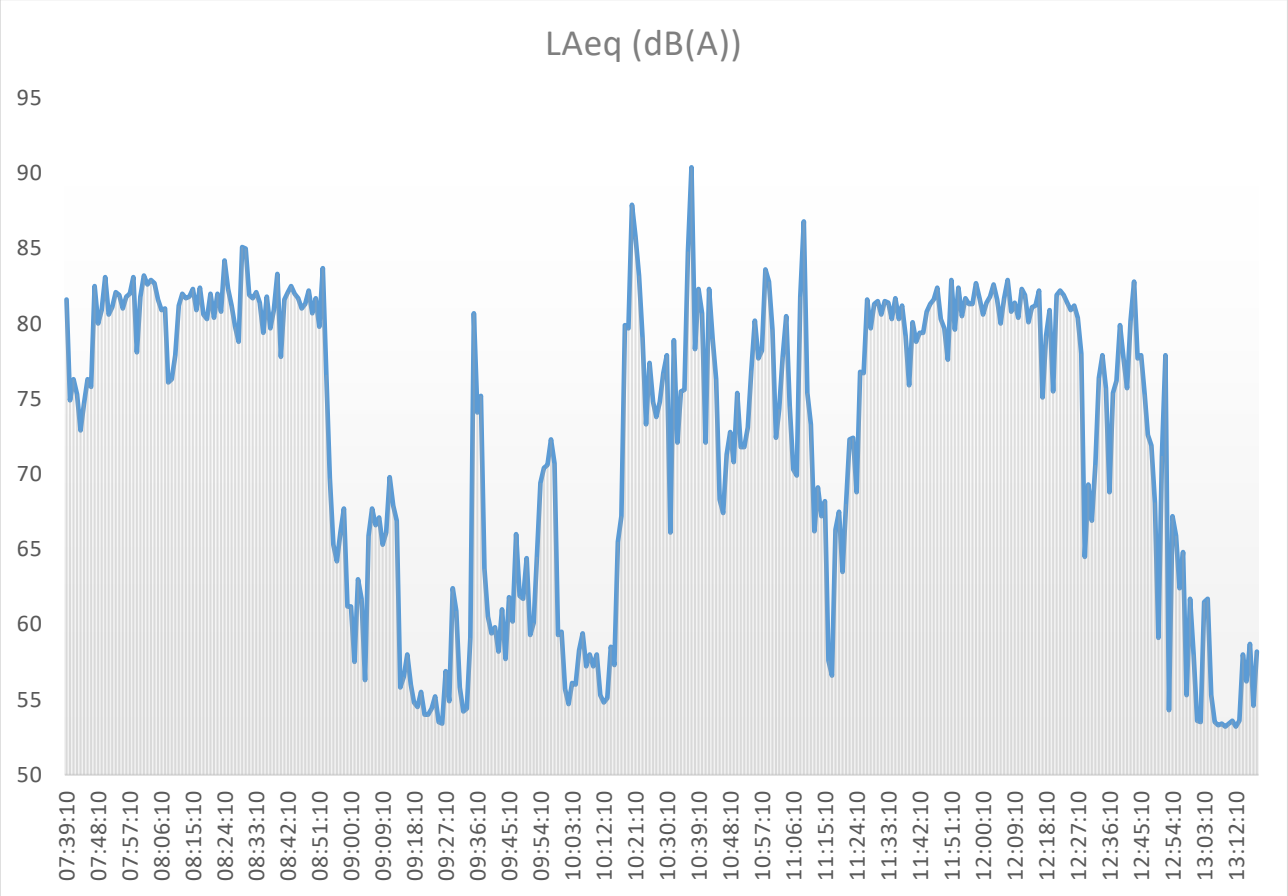
PERSONAL NOISE DOSIMETER REPORT FORM

Site	Section Mill
Location	Roll Shop
Operator's name	Keith Gunstone
Date of monitoring	29th April 2021
Activity during monitoring	Roll shop operative
Personal Daily Noise Exposure, Lep'd (Taking into account the L_{Aeq} reading from dosimeter and their shift length)	84.0
Average noise exposure, L_{Aeq} (dB)	82.0
Comments and observations	DoseBadge placed on at 09:48am and left on for a representative period of 2hr 37min duration. DoseBadge serial number 2105814. Shift length is from 6am to 6pm. A 45- minute break period is taken during his shift. Operative wearing hearing protection "helmet cans".

(data graph unable to be retrieved)

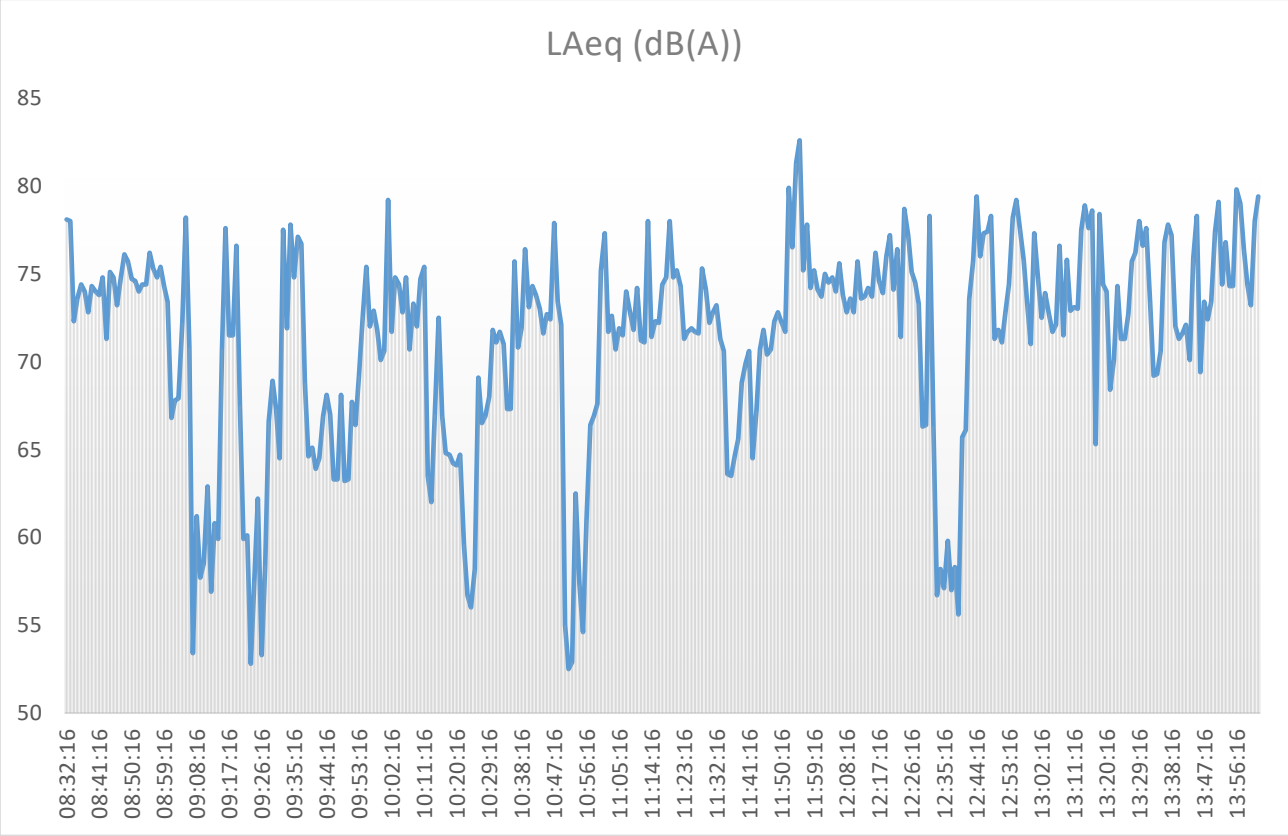
PERSONAL NOISE DOSIMETER REPORT FORM

Site	Section Mill
Location	Billet Bank West End
Operator's name	Remis Vaskevicius
Date of monitoring	29th July 2021
Activity during monitoring	Operative. Billet bank, office and W/H.
Personal Daily Noise Exposure, Lep'd (Taking into account the L_{Aeq} reading from dosimeter and their shift length)	80.5
Average noise exposure, L_{Aeq} (dB)	78.7
Comments and observations	DoseBadge placed on at 8:30am and left on for a representative period of 5hr 40min duration. DoseBadge serial number 5044119. Shift length is from 5am to 5pm. Two 45-minute break period is taken during his shift. Operative not wearing hearing protection.



PERSONAL NOISE DOSIMETER REPORT FORM

Site	Section Mill
Location	Billet Bank
Operator's name	Michael Farmer
Date of monitoring	29th July 2021
Activity during monitoring	Crane Driver
Personal Daily Noise Exposure, Lep'd (Taking into account the L_{Aeq} reading from dosimeter and their shift length)	75.6
Average noise exposure, L_{Aeq} (dB)	73.8
Comments and observations	DoseBadge placed on at 8:32am and left on for a representative period of 5hr 31min duration. DoseBadge serial number 1056582. Shift length is from 6am to 6pm. Two 30-minute break period is taken during his shift. Operative not wearing hearing protection.



Appendix C – Adequacy of Hearing Protection

Table showing effectiveness of hearing protection

The resultant A-weighted noise level at the ear is given by subtracting the SNR value for the protector from the C-weighted sound pressure level. Where the performance of the hearing protection is more critical, the resultant noise at the ear is calculated by using the attenuation of the hearing protection at individual octave bands using the frequency analysis of the noise. EEUK Group Ltd recommends that attenuation values are based on reducing noise at the ear to between 70-79dB(A) and to allow a +4dB correction for "real world" conditions. Noise at the ear of less than 70dB(A) is considered over-protection and noise at the ear equal to or exceeding 80dB(A) is under-protection.

Protector does not give adequate protection "under-protects" or "over-protects"

Protector gives adequate protection

Location / Operation	Noise level dB(A)	Noise level dB(C)	Minimum SNR to reduce to 70 dB	Examples of resultant noise at ear for protectors dB *Hearing protection currently offered is shown in underline*					
				3M Ear Caps SNR23	3M Peltor Optime II Headband SNR31	Optime II Helmet Mounted SNR30	3M EAR Ultrafit SNR32	Howard Leight Laser Leight SNR35	ES-01-020 Earsoft Plugs SNR39
SNR				23	31	30	32	35	39
By recooporator at back of furnace	85.5	90.9	25	72	64	65	63	60	56
By steps and fire exit. Sub station. Charging boggie drive	85.0	89.0	23	70	62	63	61	58	54
By furnace skids	86.1	90.2	24	71	63	64	62	59	55
By furnace. Fan noise, low frequency. Periodic air release.	93.5	98.7	33	80	72	73	71	68	64
Boogking line walkway - bar passing	88.4	92.2	26	73	65	66	64	61	57
By stand 0	86.5	90.2	24	71	63	64	62	59	55
By control plan. Rooghing. Clarkson sounded.	91.0	94.9	29	76	68	69	67	64	60
By control plan. Rooghing. Clarkson not sounding.	84.5	88.5	23	70	62	63	61	58	54
By CP1 - no bars. At front of CP.	84.1	87.2	21	68	60	61	59	56	52
Outside CP1. Bar pass/drop.	87.9	90.4	24	71	63	64	62	59	55
Pomini by stand 10. Approx. 5m distance away (unsafe to stand closer)	85.6	89.0	23	70	62	63	61	58	54
Pomini control station.	85.1	88.5	23	70	62	63	61	58	54
Devide shears.	88.8	90.5	25	72	64	65	63	60	56
South end of cooling bay. Machine noise and motor noise constant and banging.	87.4	92.3	26	73	65	66	64	61	57
Blad building area. Banging in the distance.	90.1	90.0	24	71	63	64	62	59	55
Short extraction. Burning/cutting.	101.9	100.9	35	82	74	75	73	70	66
Short extraction. No cutting.	96.9	96.8	31	78	70	71	69	66	62
Cold shears. By cage. Outside CP.	101.6	101.2	35	82	74	75	73	70	66
Stacker. By rotating magnet profiles station 7.	92.7	92.5	27	74	66	67	65	62	58
Outside CP3 at Stacker.	89.3	89.9	24	71	63	64	62	59	55
Roll shop. Tacchi lathe. At control panel.	85.7	85.4	19	66	58	59	57	54	50
Roll shop. Geminis cathe. Finishing cot.	80.4	82.2	16	63	55	56	54	51	47
Roll shop. Herkules lathe. At control panel.	83.5	83.9	18	65	57	58	56	53	49
Roll shop. Impact gun.	103.8	102.2	36	83	75	76	74	71	67
Roll shop. Grinder.	92.8	91.1	25	72	64	65	63	60	56
Roll shop. Pneumatic impact gun.	101.2	100.9	35	82	74	75	73	70	66
Roll shop. In roll shop while shearing on walkway by Tocchi lathe. (need to know what product). 70/bangle.	82.6	84.3	18	65	57	58	56	53	49
Roll shop. In roll shop. While shearing by fire exit and wall to mill.	86.0	86.8	21	68	60	61	59	56	52

Appendix D – Calibration Certificates

CASELLA

Certificate of Conformity and Calibration

Instrument Model:-	**CEL-350**	**Microphone Type:-**	**CEL-252**
Serial Number	5044119	Serial Number	53585
Firmware revision	V1.14		
Instrument Class/Type:-	2		
Test Conditions:-	21.6 °C 50.6 %RH 1019.7 mBar	**Test Engineer:-** **Date of Issue:-**	Malcolm Neale September 5, 2019

Declaration of conformity:-

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications, which is designed to meet the requirements of IEC 61252 Ed 1.1 2002-03 and ANSI S1.25:1991. 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.

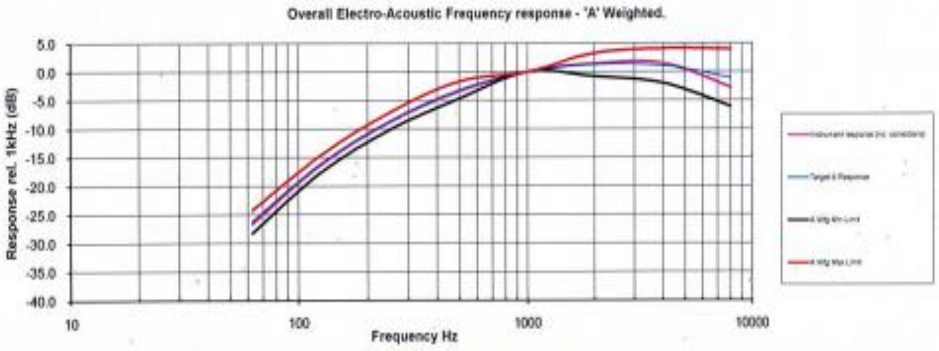
Test Summary:-

Self generated Noise test	**All Tests Pass**
Frequency weightings A/C/Z	**All Tests Pass**
Level Linearity tests	**All Tests Pass**
Response to short duration signals	**All Tests Pass**
Response to unipolar pulses	**All Tests Pass**
Overload indicator	**All Tests Pass**
Time weightings tests	**All Tests Pass**
C-weighting peak response	**All Tests Pass**
Acoustic Tests (Please see below)	**All Tests Pass**

Combined Electro-Acoustic Frequency Response - A Weighted

IEC 61252 Section 7.2, - Frequency Weighting.

The following A-Weighted frequency response graph shows this instruments overall frequency response based upon the application of multi-frequency pressure field calibrations. The microphones Pressure to Free field correction coefficients are applied to pressure response. Reference level taken at 1kHz.



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Tested to test sheet TP385 revision 07-00

CASELLA

Certificate of Conformity and Calibration

Instrument Model:-	**CEL-350**	**Microphone Type:-**	**CEL-252**
Serial Number	1056582	Serial Number	56623
Firmware revision	V1.14		
Instrument Class/Type:-	2		
Test Conditions:-	21.5 °C 48.9 %RH 1019.1 mBar	Test Engineer:- Date of Issue:-	Malcolm Neale September 5, 2019

Declaration of conformity:-

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications, which is designed to meet the requirements of IEC 61252 Ed 1.1 2002-03 and ANSI S1.25:1991. 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:-

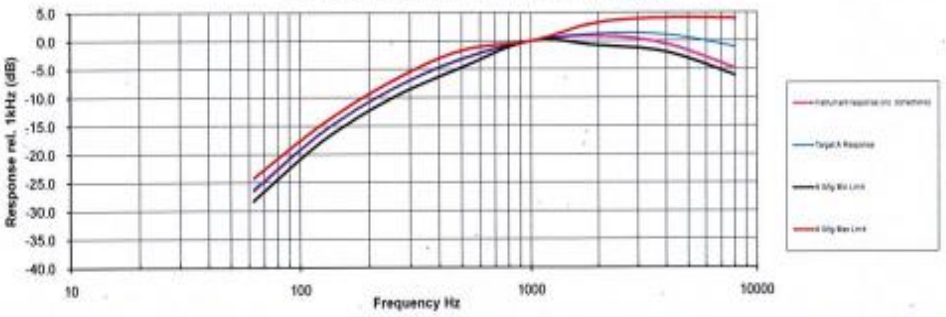
Self generated Noise test	**All Tests Pass**
Frequency weightings A/C/Z	**All Tests Pass**
Level Linearity tests	**All Tests Pass**
Response to short duration signals	**All Tests Pass**
Response to unipolar pulses	**All Tests Pass**
Overload indicator	**All Tests Pass**
Time weightings tests	**All Tests Pass**
C-weighting peak response	**All Tests Pass**
Acoustic Tests (Please see below)	**All Tests Pass**

Combined Electro-Acoustic Frequency Response - A Weighted

IEC 61252 Section 7.2, - Frequency Weighting.

The following A-Weighted frequency response graph shows this instruments overall frequency response based upon the application of multi-frequency pressure field calibrations. The microphones Pressure to Free field correction coefficients are applied to pressure response. Reference level taken at 1kHz.

Overall Electro-Acoustic Frequency response - 'A' Weighted.



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Tested to test sheet TP385 revision 07-00

CASELLA

Certificate of Conformity and Calibration

Instrument Model:-	**CEL-350**	**Microphone Type:-**	**CEL-252**
Serial Number	5044601	Serial Number	30262
Firmware revision	V1.14		
Instrument Class/Type:-	2		
Test Conditions:-	21.5 °C 49 %RH 1019.7 mBar	Test Engineer:- Date of Issue:-	Malcolm Neale September 5, 2019

Declaration of conformity:-

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications, which is designed to meet the requirements of IEC 61252 Ed 1.1 2002-03 and ANSI S1.25:1991. 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:-

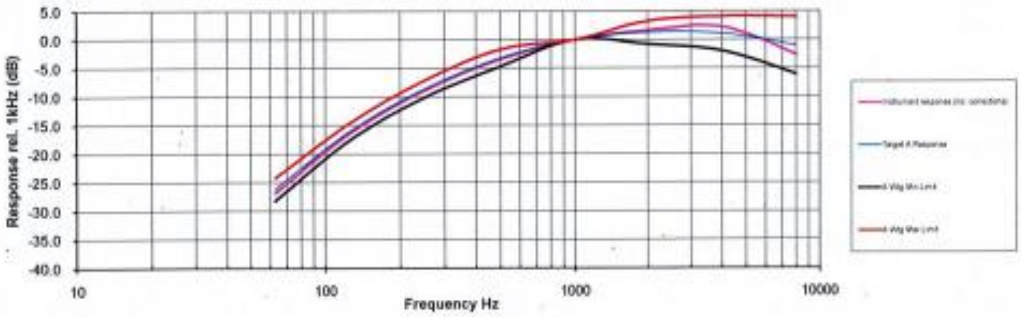
Self generated Noise test	**All Tests Pass**
Frequency weightings A/C/Z	**All Tests Pass**
Level Linearity tests	**All Tests Pass**
Response to short duration signals	**All Tests Pass**
Response to unipolar pulses	**All Tests Pass**
Overload indicator	**All Tests Pass**
Time weightings tests	**All Tests Pass**
C-weighting peak response	**All Tests Pass**
Acoustic Tests (Please see below)	**All Tests Pass**

Combined Electro-Acoustic Frequency Response - A Weighted

IEC 61252 Section 7.2. - Frequency Weighting.

The following A-Weighted frequency response graph shows this instruments overall frequency response based upon the application of multi-frequency pressure field calibrations. The microphones Pressure to Free field correction coefficients are applied to pressure response. Reference level taken at 1kHz.

Overall Electro-Acoustic Frequency response - 'A' Weighted.



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Tested to test sheet TP385 revision 07-00

CASELLA

Certificate of Conformity and Calibration

Instrument Model:-	**CEL-350**	**Microphone Type:-**	**CEL-252**
Serial Number	0556337	Serial Number	53766
Firmware revision	V1.14		

Instrument Class/Type:- 2

Test Conditions:-	21.6 °C 55.3 %RH 1007.6 mBar	**Test Engineer:-** **Date of Issue:-**	Malcolm Neale September 4, 2019

Declaration of conformity:-

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications, which is designed to meet the requirements of IEC 61252 Ed 1.1 2002-03 and ANSI S1.25:1991. 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.

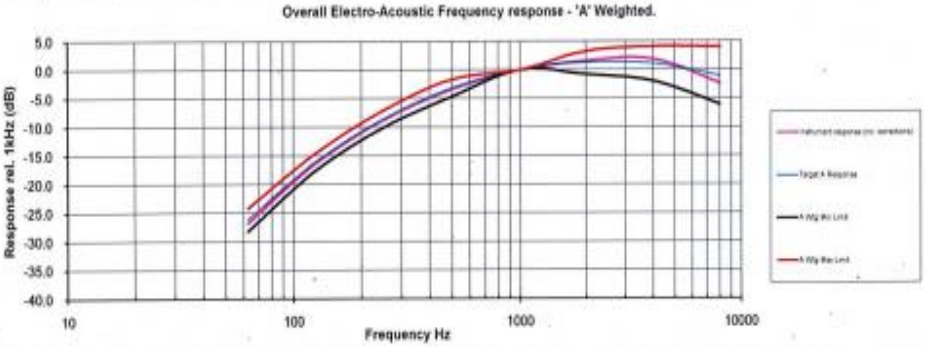
Test Summary:-

Self generated Noise test	**All Tests Pass**
Frequency weightings A/C/Z	**All Tests Pass**
Level Linearity tests	**All Tests Pass**
Response to short duration signals	**All Tests Pass**
Response to unipolar pulses	**All Tests Pass**
Overload indicator	**All Tests Pass**
Time weightings tests	**All Tests Pass**
C-weighting peak response	**All Tests Pass**
Acoustic Tests (Please see below)	**All Tests Pass**

Combined Electro-Acoustic Frequency Response - A Weighted

IEC 61252 Section 7.2, - Frequency Weighting.

The following A-Weighted frequency response graph shows this instruments overall frequency response based upon the application of multi-frequency pressure field calibrations. The microphones Pressure to Free field correction coefficients are applied to pressure response. Reference level taken at 1kHz.



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Tested to test sheet TP385 revision 07-00

CASELLA

Certificate of Conformity and Calibration

Instrument Model:-	dBadge2/IS	**Microphone Type:-**	CEL-252
Serial Number	2105873	**Serial Number**	88251
Firmware revision	V06.00		

Instrument Class/Type:- 2

Test Conditions:-	29 °C 67 %RH 1004 mBar	**Test Engineer:-** **Date of Issue:-**	Nunzio Dipace August 26, 2020

Declaration of conformity:-

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications, which is designed to meet the requirements of IEC 61252 Ed 1.1 2002-03 and ANSI S1.25:1991. 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.

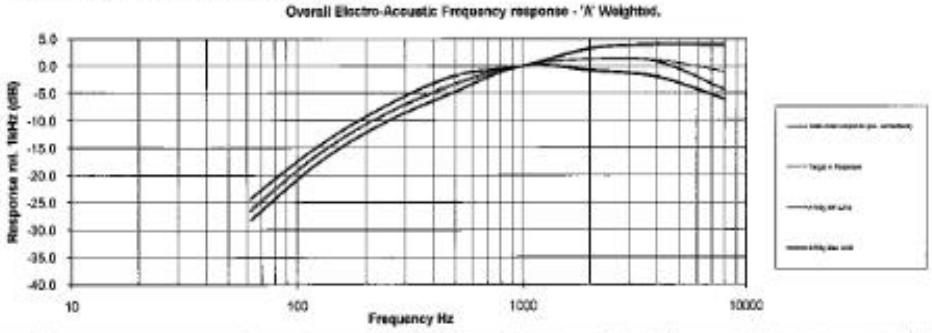
Test Summary:-

Self generated Noise test	**All Tests Pass**
Frequency weightings A/C/Z	**All Tests Pass**
Level Linearity tests	**All Tests Pass**
Response to short duration signals	**All Tests Pass**
Response to unipolar pulses	**All Tests Pass**
Overload indicator	**All Tests Pass**
Time weightings tests	**All Tests Pass**
C-weighting peak response	**All Tests Pass**
Acoustic Tests (Please see below)	**All Tests Pass**

Combined Electro-Acoustic Frequency Response - A Weighted

IEC 61252 Section 7.2, - Frequency Weighting.

The following A-Weighted frequency response graph shows this instruments overall frequency response based upon the application of multi-frequency pressure field calibrations. The microphones Pressure to Free field correction coefficients are applied to pressure response. Reference level taken at 1kHz.



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Tested to test sheet TPS32 revision 05-09

CASELLA

Certificate of Conformity and Calibration

Instrument Model:-	**dBadge2/IS**	**Microphone Type:-**	**CEL-252**
Serial Number	2105814	Serial Number	89539
Firmware revision	V06.00		
Instrument Class/Type:-	2		
Test Conditions:-	31 °C 51 %RH 999 mBar	Test Engineer:- Date of Issue:-	Nunzio Dipace August 26, 2020

Declaration of conformity:-

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications, which is designed to meet the requirements of IEC 61252 Ed 1.1 2002-03 and ANSI S1.25:1991. 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:-

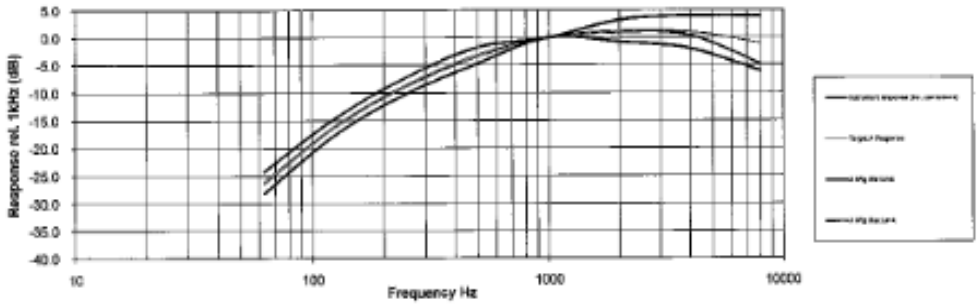
Self generated Noise test	**All Tests Pass**
Frequency weightings A/C/Z	**All Tests Pass**
Level Linearity tests	**All Tests Pass**
Response to short duration signals	**All Tests Pass**
Response to unipolar pulses	**All Tests Pass**
Overload indicator	**All Tests Pass**
Time weightings tests	**All Tests Pass**
C-weighting peak response	**All Tests Pass**
Acoustic Tests (Please see below)	**All Tests Pass**

Combined Electro-Acoustic Frequency Response - A Weighted

IEC 61252 Section 7.2, - Frequency Weighting.

The following A-Weighted frequency response graph shows this instruments overall frequency response based upon the application of multi-frequency pressure field calibrations. The microphones Pressure to Free field correction coefficients are applied to pressure response. Reference level taken at 1kHz.

Overall Electro-Acoustic Frequency response - 'A' Weighted.



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Tested to test sheet TP502 revision 05-00

CASELLA

Certificate of Conformity and Calibration

Instrument Model:-	dBadge2/IS	**Microphone Type:-**	CEL-252
Serial Number	2105818	Serial Number	89543
Firmware revision	V06.00		
Instrument Class/Type:-	2		
Test Conditions:-	29 °C 69 %RH 1001 mBar	Test Engineer:- Date of Issue:-	Nunzio Dipaco August 26, 2020

Declaration of conformity:-

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications, which is designed to meet the requirements of IEC 61252 Ed 1.1 2002-03 and ANSI S1.25:1991. 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:-

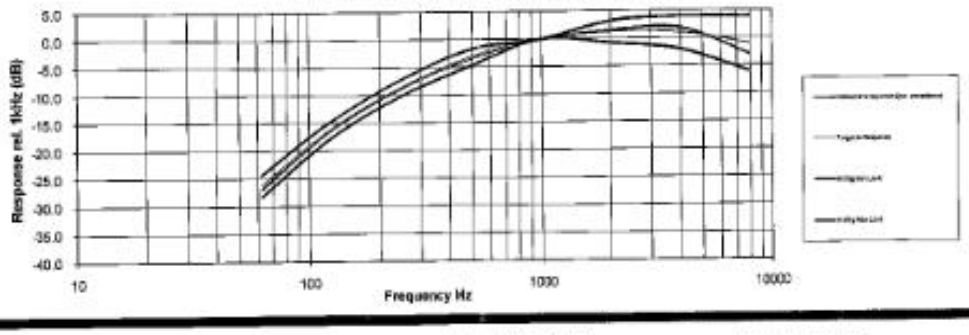
Self generated Noise test	**All Tests Pass**
Frequency weightings A/C/Z	**All Tests Pass**
Level Linearity tests	**All Tests Pass**
Response to short duration signals	**All Tests Pass**
Response to unipolar pulses	**All Tests Pass**
Overload indicator	**All Tests Pass**
Time weightings tests	**All Tests Pass**
C-weighting peak response	**All Tests Pass**
Acoustic Tests (Please see below)	**All Tests Pass**

Combined Electro-Acoustic Frequency Response - A Weighted

IEC 61252 Section 7.2, - Frequency Weighting.

The following A-Weighted frequency response graph shows this instruments overall frequency response based upon the application of multi-frequency pressure field calibrations. The microphones Pressure to Free field correction coefficients are applied to pressure response. Reference level taken at 1kHz.

Overall Electro-Acoustic Frequency response - 'A' Weighted.



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Tested to test sheet TPS02 revision 06-00

CASELLA

Certificate of Conformity and Calibration

Instrument Model:-	dBadge2/IS	**Microphone Type:-**	CEL-252
Serial Number	2105945	Serial Number	87531
Firmware revision	V06.00		
Instrument Class/Type:-	2		
Test Conditions:-	29 °C 67 %RH 1004 mBar	**Test Engineer:-** **Date of Issue:-**	Nunzio Dipace August 26, 2020

Declaration of conformity:-

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications, which is designed to meet the requirements of IEC 61252 Ed 1.1 2002-03 and ANSI S1.25:1991. 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:-

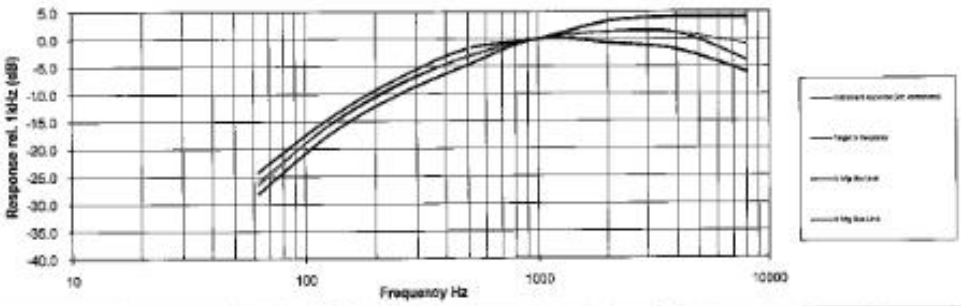
Self generated Noise test	**All Tests Pass**
Frequency weightings A/C/Z	**All Tests Pass**
Level Linearity tests	**All Tests Pass**
Response to short duration signals	**All Tests Pass**
Response to unipolar pulses	**All Tests Pass**
Overload indicator	**All Tests Pass**
Time weightings tests	**All Tests Pass**
C-weighting peak response	**All Tests Pass**
Acoustic Tests (Please see below)	**All Tests Pass**

Combined Electro-Acoustic Frequency Response - A Weighted

IEC 61252 Section 7.2, - Frequency Weighting.

The following A-Weighted frequency response graph shows this instruments overall frequency response based upon the application of multi-frequency pressure field calibrations. The microphones Pressure to Free field correction coefficients are applied to pressure response. Reference level taken at 1kHz.

Overall Electro-Acoustic Frequency response - 'A' Weighted.



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Appendix E – Qualifications

EEUK Group was requested to carry this Workplace Noise survey. The site work was performed by an associate level member for the BOHS faculty and works under the supervision of a certified Occupational Hygienist holding the Certificate of Operational Competence in Occupational Hygiene. Should you require further guidance in regard to this report's recommendations or findings then it is recommended that assistance is sought from one of EEUK Group's certified Occupational Hygienists.

Southampton SOLENT University

DANIEL BHATT

has been awarded the degree of

MASTER OF SCIENCE

with MERIT

having followed an approved programme in

APPLIED ACOUSTICS

November 2018

West of Spithead

Admiral The Right Honourable Lord West of Spithead
GCB DSC PC DLitt

Graham Baldwin

Vice-Chancellor
Professor Graham Baldwin

2017MAPACF1096491

13818481

Faculty of Occupational Hygiene

BOHS

Daniel Bhatt

has successfully completed the course

W503 - Noise - Measurement and its Effects

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advancing occupational hygiene worldwide

IOHA

Leonard Morris
Chief Examiner

May 2020
Certificate No: 20200515-47297-13918

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Institute of Acoustics

Certificate of Membership

This is to certify that

Mr Daniel Bhatt

has been elected as a

Associate Member

of the
Institute of Acoustics

Given under the seal of the Institute
in accordance with the
Articles of Association and By-Laws

President

Institute Secretary

Valid Until 31-01-2022

Membership Number 51014

The certificate remains the property of the Institute and shall be returned to the Institute on demand.
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