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Muffling of Pneumatic Handheld Tools – Leading Practice

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Contents

Sishen Noise Risk Management Strategy

1. Leadership-Driven Strategy (Top-Level Commitment)
- At the highest level, Kumba embeds noise risk management into its business strategy and Zero Harm vision.
- Executive leadership sets clear expectations that health risks are non-negotiable

This ensures that noise control is not treated as a compliance task, but as a strategic business priority

2. Risk-Based Approach to Noise Management

At the core of Sishen's strategy is a structured risk assessment process, which includes:
- Baseline RA, Issue-based RA (Bow-tie)
- Noise risk profiling of tasks and equipment

This ensures that high-risk activities—such as the use of pneumatic handheld tools—are identified early and prioritised for intervention.

3. Focus on Engineering Controls (Hierarchy of Controls)
- A key principle of the strategy is prioritising engineering controls over administrative measures and PPE.
- This reflects a shift from: Compliance-based monitoring → to proactive risk elimination

4. Integration into Critical Control Management

Noise controls, such as mufflers, are formally classified as Critical Controls, meaning:
- They must always be available, functional, used and effectiveness verified regularly

5. Monitoring, Verification, and Continuous Improvement (Noise surveys, Inspections, VFLs)

These tools ensure:
- Compliance with controls, Early detection of failures or deviations & continuous improvement of noise control measures

6. Maintenance and Equipment Availability
- A critical part of the strategy is ensuring that controls remain effective
- This prevents control failure due to poor upkeep or lack of resources.

7. MOSH Leading Practice Adoption Framework
- Sishen implements noise control initiatives using the MOSH Adoption System,

Road Map to noise leading practice

- Early engagement with MOSH Noise team in 2016
- Leading Practice Launch in 2019 (Tyre deflation)
- Case Study: MOSH Guidance note for equipment noise measurement, Sishen mine, 2021.
- Measurements or all equipment in accordance with the MOSH guidance note for noise measurement of equipment to ensure conformance with mine health and safety council (MHSC) milestones.
- Structured approach on identification and prioritisation of high emitting noise equipment using the MOHS Critical Noise Screening Tool.
- Developed a Top 10 Noisy Equipment Register.
- Commenced with investigation of noise control initiatives for Top 10 noise sources including the impact wrench and PT Gun.

Impact Wrench Leading Practice

Impact wrench use

Impact wrenches are widely used in the mining industry for tasks that require the rapid tightening or loosening of bolts, nuts and fasteners, during maintenance of heavy machinery, trackless mobile equipment, and during tyre change operations

Impact Wrench Leading Practice

Operational Application of Muffling

The noise reduction initiative introduced was done through the fitting of exhaust mufflers under the following operating conditions:

Tests conducted while loosening and tightening nuts on Komatsu haul truck wheel assembly

- Two impact wrenches tested (old tool and new tool)
  – Chicago Pneumatic wrench model CP6060-P15R
- Impact wrenches have ¾ “drive shaft.
- Air pressure regulated at 5.8 Bar with maximum design specification of 6.3 Bar

The mufflers on the impact wrenches are installed using the following simple steps:

- Thread of both the 90° elbow reducer and the muffler are wrapped with PTFE thread tape (Plumber’s tape) for airtight seal.
- Reducer elbow is screwed into the exhaust port of the Chicago Pneumatic impact wrench
- The muffler is screwed onto the reducer

Technical Aspects of the Practice

1

Chicago Pneumatic Wrench
The Chicago Pneumatic 6060-P15R ¾” drive is used to loosen and tighten nuts on wheel assemblies of HME and also as nut runners. Operates at maximum of 6 Bar / 90 Psi air pressure and speeds of up to 4000 rpm

2

Air Exhaust Muffler
The Air Exhaust Muffler is installed to reduce the noise generated from high pressure air release from the exhaust port of the impact wrench

3

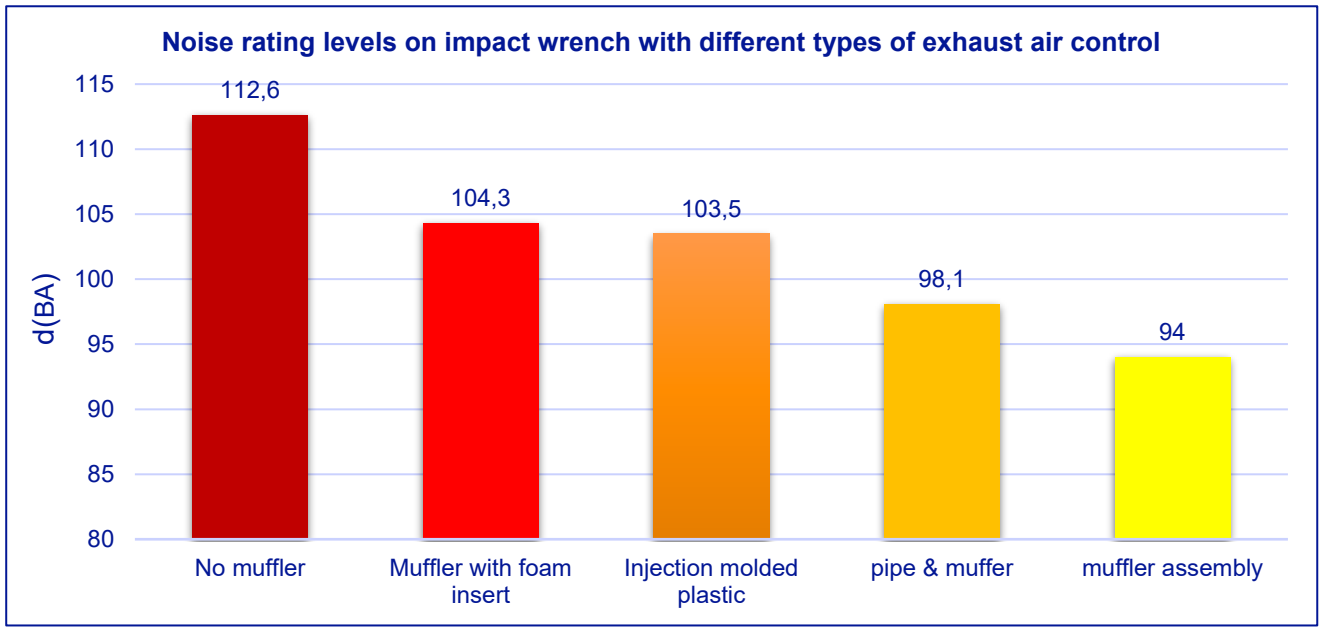
Elbow (90°) Reducer Attachment
The elbow is used to attach the muffler to the exhaust port of the impact wrench.

Muffled Impact Wrench
The three components are joined together to assemble a muffled impact wrench

Impact Wrench Leading Practice

Comparative Tests with Mufflers

Further tests were conducted on the CP6060 P15R impact wrench under free-run conditions, using different muffler configurations. Free-run testing was selected as it provided consistent readings, which were generally higher than the intermittent noise levels observed when shifting the socket between nuts. The results from the tests are summarized below.



Impact wrench leading practice

Cost Benefit Analysis

Historical cost (No muffler)	Current Cost (with muffler)
Previously, the impact wrench was custom fitted with OEM muffler: • **Cost Chicago Pneumatic**: R39,000 (excl VAT) • **Replacement rate**: 24 months dependent on use • **Annual cost**: R39,000 x 2 = R78,000.00 (excl VAT) (4 purchased every 2 years)	**Cost inclusive of alteration/addition of muffler:** • **Cost Chicago Pneumatic**: R39,000 (excl VAT) x 4 every 2 years • **Muffler cost per unit**: R 813 per muffler x 4 = R3252 • **Elbow/reducer attachment per unit**: R 200/elbow x 4 = R800

Financial Impact (Increase)

Annual increased expenditure only every 2 years:

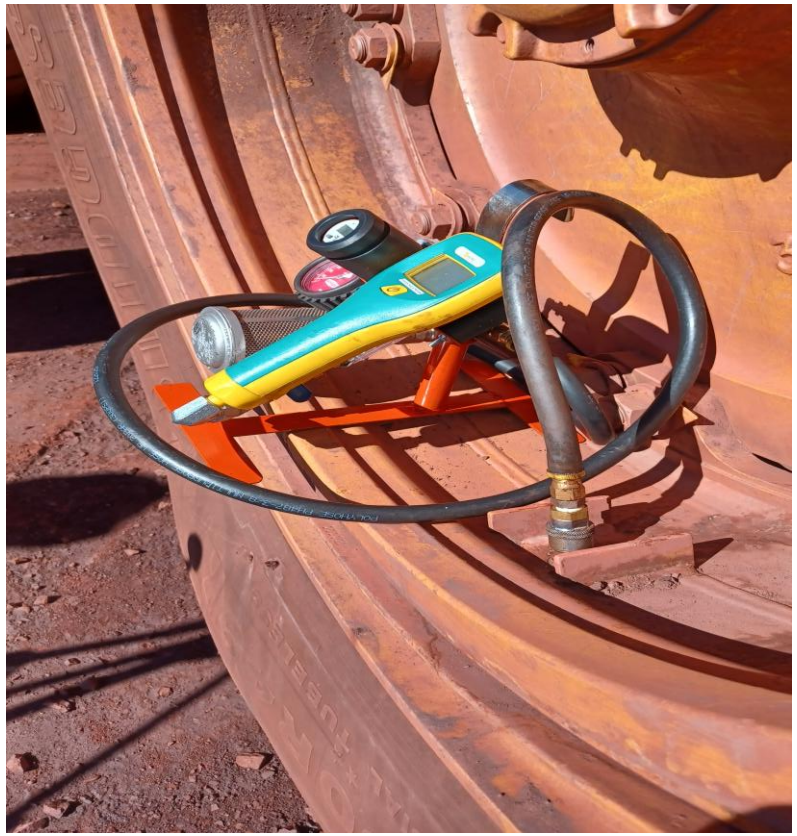
- **Previous:** R156,000 (excl VAT)
- **Current:** R156,000 (excl VAT) + R3252 + R800 = R160,052 (increase of R4052)

The improvement introduces an additional cost due to the installation of aftermarket mufflers. However, it provides significant long-term benefits by reducing the risk of NIHL, which have an impact on the quality of life of affected employees and also reduces the risk of compensation costs.

Pressure Testing (PT) Gun Leading Practice

Pressure Testing gun use

Pressure testing guns are utilized in the mining industry for tyre maintenance. These combination instruments are designed to accurately measure tyre pressure, determine the internal tyre chamber temperature, and indicate the nitrogen percentage inside the tyre.



Pressure Testing (PT) Gun Leading Practice

Operational Application of Muffling

During pressure testing process, noise primarily arises from several sources, including the release of air pressure, which can create hissing or popping sounds, and the operation of compressors that produce continuous noise from motor and exhaust venting.

- Sishen Mine pioneered earth mover (EM) tyre pressure control using chamber air temperature monitoring.
- This led to the first EM tyre temperature measurement device and improved “hot” pressure accuracy.
- The original probe thermometer design evolved into the PT Gun with Topy.
- This innovation paved the way for modern EM-focused TPMS solutions

Sishen Mine has enhanced the PT Gun by fitting it with a muffler, effectively reducing noise emissions during tyre testing and improving overall operating conditions, health, and safety for employees.

Technical Aspects of the Practice

1

Handheld Temperature Gauge
Used to measure tyre chamber temperature and adjust pressure accordingly. Temperature is compared with recommended cold inflation values using a heat chart. Air is gradually released until the reading stabilizes (about one minute or until the display stops changing).

2

Handheld Pressure Gauge
Used to accurately measure tyre pressure using an approved handheld gauge. Accuracy is ensured through regular calibration against a master gauge and adjusted, as necessary.

3

Handheld Nitrogen Percentage Indicator
The Nitrogen Percentage Indicator is a hand-held instrument for indicating the Nitrogen percentage of the Nitrogen source..

4

Inline Water Trap
The Inline Water Trap is designed to remove water, oil, dirt and rust from the compressed air, protecting the pneumatic equipment from corrosion, seals damage and lubrication blow-out..

5

Air Exhaust Muffler
The Air Exhaust Muffler is installed to reduce the noise generated during the temperature pressure testing process.

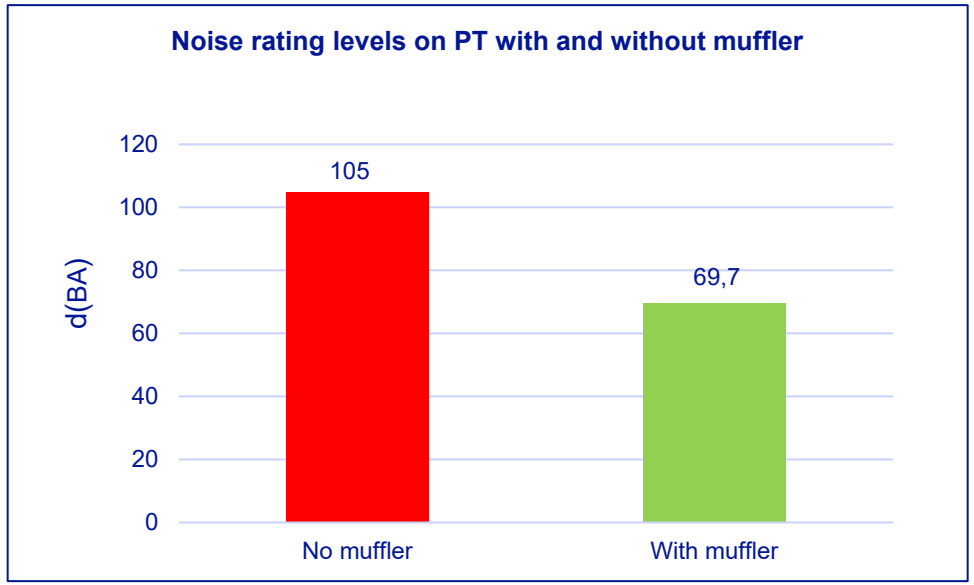
6

Combination Tool
The combination tool is used to join or merge the different parts into one unit, which is referred to as the PT Gun in this document.

Pressure Testing (PT) Gun Leading Practice

Comparative Tests with or without a muffler

Noise measurements were conducted on the combination tool (PT Gun) in both configurations—without a muffler and with a muffler—demonstrating a significant reduction in noise levels when the muffler was installed. The results from the tests are summarized below.



Pressure Testing (PT) Gun Leading Practice

Cost Benefit Analysis

Historical cost (No inline water trap)	Current Cost (With inline water trap)
Previously, each sensor had an average lifespan of approximately 2 weeks. • **Cost per sensor:** R1,350 • **Total nitrogen gauges at Sishen:** 8 • **Monthly replacement rate:** 16 sensors • **Monthly cost:** 16 sensors x R1,350 = R21,600 • **Annual cost:** R21,600 x 12 months = R259,200	With advancements, each sensor now has an expected lifespan of about 4 months. • **Annual replacement requirement:** 24 sensors • **Annual cost:** 24 sensors x R1,350 = R32,400

Financial Impact (Savings)

- **Annual savings:** R259,200 (previous) - R32,400 (current) = R226,800
- **Total reduction in cost per annum:** R226,800

This improvement represents significant cost savings and operational efficiency for Sishen by reducing sensor replacement frequency and associated expenses.

Health and Safety Benefits

Reduction in Mobile Plant Downtime Due to Faster Deflation

- Faster, controlled tyre deflation reduces mobile plant downtime and improves productivity.

Reduction in Hand Injuries and Accidental Release of Stored Energy

- Controlled release of stored energy lowers the risk of hand injuries.

Reduced Dust Exposure

- Muffling during deflation reduces dust exposure and improves air quality.

Lower Risk of Tire Pyrolysis (Tyre Bursts)

- Reduced heat and stress lowers the risk of tyre pyrolysis and bursts.

Enhanced Eye Protection against Projected Particles

- Minimised particle projection enhances eye safety during maintenance

Key Learnings

- Identify, acknowledge your noise problem
- Challenge the status quo
- Garnering Leadership/Management Support
- Collaboration with other stakeholders'. OEM, Engineering Teams, MOSH Team, Experts. etc.
- Taking people along
- Continual Improvements
- Sharing of best practices

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THANK YOU