

Technical Article-7 **Mechanisation and Maintenance in Mines**

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The mining industry has come a long way from the days of excavation through labours manually to highly equipped machineries. Today, mechanisation plays a crucial role in enhancing the productivity and safety of mining operations. The use of heavy machinery and advanced technology has revolutionized the sector, but with great power comes great responsibility. Proper maintenance is the key to ensure that these machines perform optimally and safely. Here, we will explore the significance of mechanisation and maintenance in mines, highlighting the balance between efficiency and safety.

The Rise of Mechanisation in Mining

Mechanisation in mining involves the use of various machines and technologies to extract minerals and ores from the Earth's crust. This shift from manual labour to machines has greatly increased the speed and scale of mining operations, making it more efficient and cost-effective. Some key mechanisation technologies in mining include:

Excavators and Loaders: These heavy machines are used to dig, scoop, and transport materials from the mining site.

Drilling Equipment: Drills and rock breakers are essential for creating blast holes and breaking down rock.

Conveyors and Haul Trucks: These are responsible for moving materials from the extraction site to the processing or storage areas.

Automated Equipment: Advance in robotics and automation have introduced autonomous vehicles, remote-controlled machines, and even drones for surveying and monitoring.

Data Analytics and Sensors: Mines with modern machineries utilize data analytics and sensors to monitor machine health (On board Diagnostic), safety conditions, and predict maintenance needs.

Benefits and Challenges

The mechanisation of mining has brought a large number of advantages:

Efficiency and Productivity: Mechanisation increases mining output and efficiency, meeting the ever-growing demand for resources.

Precision and Consistency: Machines can perform tasks with a high level of precision and consistency, leading to more accurate and uniform results. This is particularly important in tasks like drilling, blasting, and ore sorting.

Faster Operations: Mechanized mining processes are generally faster than manual methods. This speed can lead to quicker extraction, processing, and transportation of minerals, ultimately boosting productivity.

Safety: Automation minimizes risks to human workers, reducing accidents and injuries.

Cost Reduction: Reduced labour costs and improved efficiency contribute to lower operating costs.

Environmental Responsibility: Sustainable practices and technology adoption contribute to a more responsible mining industry.

While mechanization in mining offers numerous benefits, it also comes with several challenges and considerations that need to be addressed to ensure its successful implementation. Here are some of the key challenges associated with mechanization in mining:

High Initial Investment: The capital costs for acquiring and installing modern mining equipment and technology can be substantial. This initial investment can be a barrier, particularly for smaller mining operations or those in financially constrained regions.

Skilled Workforce Requirements: Mechanized mining operations require a skilled and technically competent workforce to operate and maintain the equipment. There may be a shortage of such personnel in some areas, leading to recruitment challenges.

Training and Safety: Mechanized mining demands rigorous training programs to ensure the safe operation of equipment and adherence to safety protocols. Failure to provide adequate training can result in accidents and injuries.

Environmental Concerns: Some mechanized mining processes can have environmental impacts, such as increased energy consumption, emissions, and disturbances to ecosystems. Addressing these concerns may require additional investments in environmental mitigation measures.

Maintenance and Repairs: While mechanized equipment tends to be more reliable, it still requires regular maintenance and occasional repairs. Downtime for maintenance can affect productivity, and maintenance costs need to be managed.

Equipment Maintenance Knowledge Transfer: Ensuring knowledge transfer from experienced maintenance personnel to new workers is crucial to maintain equipment reliability. The loss of experienced personnel can pose challenges.

Safety Considerations in Machine Maintenance

Safety considerations in machine maintenance in mines are more important than anything else, as mining equipment is often large, complex, and potentially hazardous. Proper maintenance is crucial to ensure the safe and efficient operation of mining machinery. Here are some key safety considerations for machine maintenance in mines,

- 1. Training and Competency:** Ensure that maintenance personnel are properly trained, certified, and have the necessary skills to work with heavy machinery. Ongoing training and competency assessments are crucial to stay up to date with evolving equipment.
- 2. Lockout/Tagout Procedures:** Implement and strictly adhere to lockout/tagout procedures when performing maintenance to prevent accidental startup of equipment. This involves isolating energy sources and using locks and tags to secure them.
- 3. Personal Protective Equipment (PPE):** Mandate the use of appropriate PPE, such as helmets, gloves, goggles, and safety boots, for maintenance personnel to protect them from potential hazards.
- 4. Fall Protection:** In situations where maintenance personnel need to work at heights, provide fall protection systems, including harnesses and guardrails, to prevent accidents.
- 5. Hazardous Materials Handling:** Ensure that maintenance staff are aware of and equipped to handle any hazardous materials they may encounter during maintenance tasks.
- 6. Documentation:** Keep accurate records of maintenance activities, including inspections, repairs, and replacement of parts. This documentation can be useful for identifying trends and ensuring compliance with safety regulations.
- 7. Emergency Response:** Have well-defined emergency response plans in place, including the location of emergency exits, first-aid stations, and communication procedures.
- 8. Safety Inspections:** Conduct regular safety inspections of equipment and machinery to identify potential hazards and address them proactively.

Best Practices for Safe Machine Maintenance

Safe machine maintenance in mines is critical to ensure the well-being of workers and the efficient operation of mining equipment. Here are some best practices for safe machine maintenance in mines,

- 1. Scheduled Maintenance:** Perform routine maintenance tasks according to a regular schedule to prevent equipment breakdowns and failures.

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2. **Equipment Isolation:** Always isolate and lock out machinery before commencing maintenance activities to prevent accidental activation.
3. **Training and Competency:** Ensure that maintenance personnel are well-trained, competent, and certified to work on specific types of equipment. They should be familiar with safety procedures, potential hazards, and the correct maintenance techniques.
4. **Risk Assessments:** Conduct thorough risk assessments before maintenance tasks, identifying potential hazards and developing strategies to mitigate them.
5. **Use the Right Tools:** Ensure that maintenance personnel have access to the appropriate tools and equipment needed for the job. Using the correct tools can prevent accidents and damage to equipment.
6. **Communication:** Establish clear communication between maintenance personnel, equipment operators, and site supervisors to coordinate maintenance tasks and ensure safety.
7. **Documentation:** Keep detailed records of maintenance activities, including work permits, checklists, and safety reports, to ensure compliance and accountability.
8. **Safety Culture:** Always try to encourage a safety-first culture within the mining organization, emphasizing the importance of safety in all operations, including machine maintenance.

Mechanisation has significantly transformed the mining industry, making it more efficient and safer. However, to gather the full benefits of mechanisation, mines must prioritize proper maintenance to ensure that their machinery runs smoothly. By striking a balance between efficiency and safety, the mining industry can continue to evolve and meet the world's growing demand for natural resources while minimizing environmental impact and ensuring the well-being of its workforce.

Safety is non-negotiable in the mining industry, particularly when it comes to machine maintenance. Heavy machinery, hazardous materials, and challenging working conditions necessitate a strong commitment to ensuring the safety of maintenance personnel. By adhering to the best practices and safety considerations outlined in this article, mining operations can mitigate risks, prevent accidents, and maintain a safe working environment, ultimately ensuring the well-being of their workforce and the long-term success of the industry.

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