Five Crucial Steps to Minimize Wear and Tear of Motion Components

Limble CMMs examines safety parameters for mechanical systems

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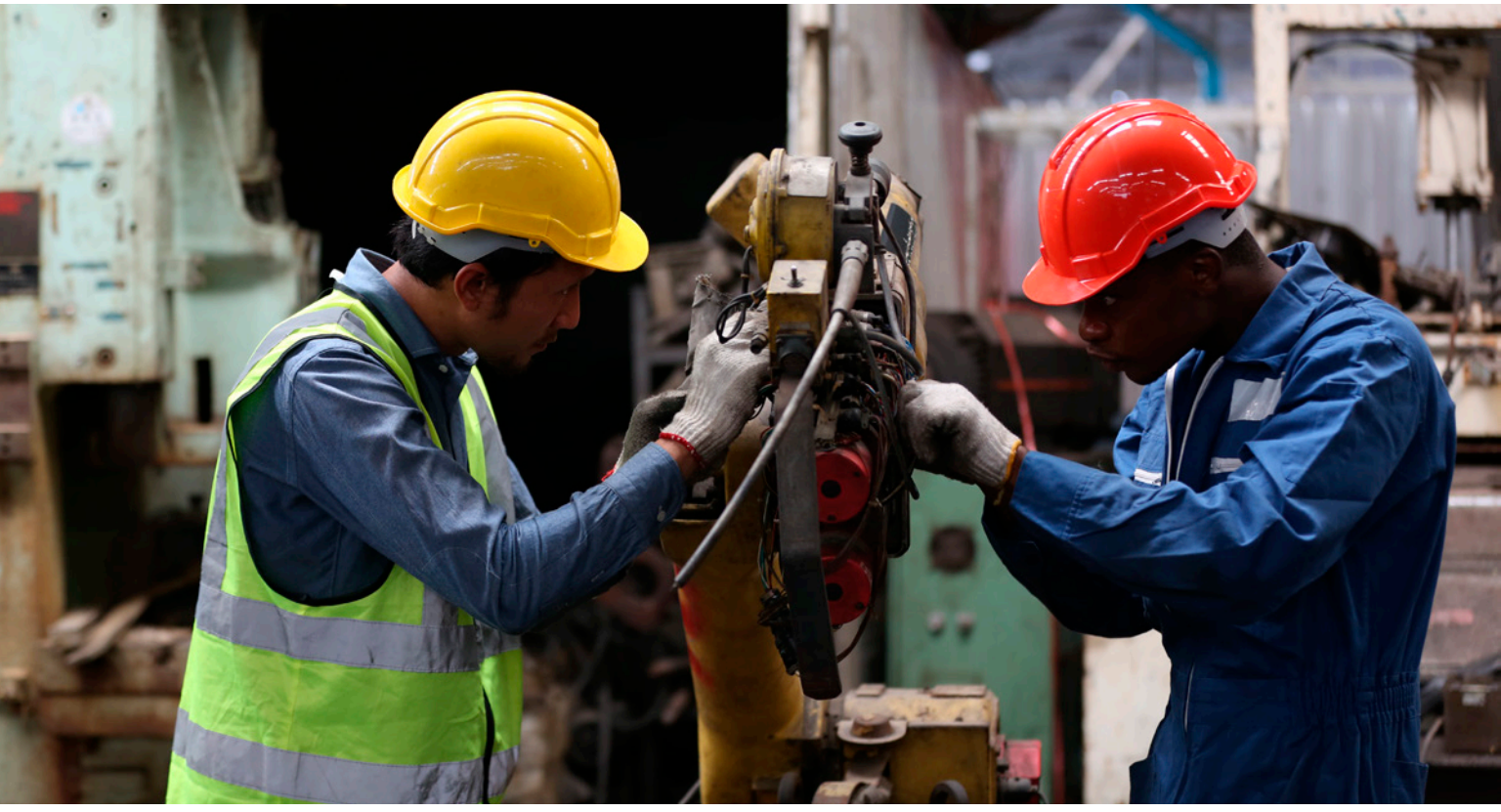

Combating wear and tear of mechanical parts enhances their performances, extends asset lifespan, and maximizes occupational safety and health.

Mechanical motion components are vital machinery parts for power and motion transmission. These components are available in different forms and sizes depending on the desired motion control or extent of power transmission. Components like bearings, motors, gear drives, shafts, belts, and couplings should retain acceptable tolerances for various mechanical systems to achieve their desired performance levels.

Mechanical motion components, though relatively small, contribute immensely to the safety of multiple systems like automobiles, manufacturing systems, elevators, water treatment facilities, etc. Motion components experience wear and tear over time caused by:

- Friction as motion surfaces come into contact with adjacent components.
- Corrosion due to exposure to chemicals, humidity, and corrosive gasses
- Fatigue emanating from repetitive stress and strain.
- Improper lubrication and system overloads

Wear and tear gradually weaken the structural integrity of mechanical components, manifesting as microscopic surface and subsurface cracks, erosion, and visible physical damage (like bends or warping). It can result in extensive machinery damage and workplace injuries. Here are different ways to combat the degradation of mechanical motion components.

1. Apply Proper Lubrication

Poor lubrication exacerbates frictional wear and tear of mechanical components. This increases the frequency and severity of mechanical failures.

To minimize wear and tear companies must prioritize the monitoring of lubrication in mechanical motion components and select the correct grade of lubricants for specific applications. Lubricants create thin films between moving parts, lowering surface friction and thus increasing the performance of mechanical systems and their effective lifespans.

Applying proper lubrication reduces the damage to mechanical motion components by:

- **Minimizing friction between surfaces in contact:** Lubricants ensure these components move without rubbing against each other. Take an example of a planetary gearbox used to transmit torque in industrial machinery. Such a system requires frequent and adequate lubrication to minimize power losses due to friction between moving parts. The amount and type of lubricant depends on the operating speed and loading conditions. Too little lubrication and the protective layer will be too thin to combat surface friction. On the other hand, excessive lubrication results in a viscous drag which causes undesirable power losses.
- **Reducing heat due to friction between moving parts:** Friction between mechanical motion parts generates heat. This heat causes regular expansion and contraction of mechanical components, causing surface damage and distortion of parts. Heat can also cause mechanical components to wear rapidly. Lubricants act as a heat dissipation medium to reduce the repetitive expansion and contraction of materials. This can extend the useful lives of components like bearings, gears, and mechanical shafts that experience repetitive motion.
- **Minimizing corrosion:** Lubricants create a thin film that can protect mechanical motion elements against exposure to moisture and other corrosive elements. Lubrication can significantly reduce wear and tear due to the corrosive effects of the immediate environment. This can decelerate part degradation by chemicals and rust. The thin film created by the lubricant blocks contact between metal surfaces and atmospheric oxygen. It prevents oxidation which causes rapid corrosion. Lubricants contain specific corrosion-inhibiting additives to provide substantial protection against corrosive agents in different operating environments.

Identify specific lubrication requirements for every piece of mechanical motion components and choose the correct grade of lubricant. Adhere to equipment lubrication procedures recommended by the original equipment manufacturer or as prescribed on lubricant packages. This reduces costly mistakes in each lubrication cycle, which might negatively affect machinery performance.

2. Conduct Regular Preventive Maintenance

Preventive maintenance involves specific activities performed over fixed intervals or based on equipment utilization levels. Scheduled maintenance activities should be conducted even if assets are operating as intended. The goal of a preventive maintenance program is to minimize the probability of equipment breakdowns and frequent downtime that lowers the efficiency of mechanical systems.

Some common preventive maintenance activities include:

- Equipment inspection
- Routine cleaning
- Lubrication
- Equipment calibration
- Replacing critical components like belts, bearings, or couplings
- Exercising or testing less frequently utilized equipment.

Establishing and sustaining a preventive maintenance program for mechanical motion elements takes time and requires substantial financial investments. It begins with auditing facilities to identify machinery maintenance needs and define respective maintenance schedules. The schedule outlines daily, weekly, monthly, and yearly maintenance tasks.

Given the sophistication of modern machinery, it may be necessary to invest in digital maintenance tools to complement planning and maintenance evaluation. There are multiple scalable preventive maintenance solutions to cater to different grades and types of mechanical motion components.

Conducting regular preventive maintenance reduces the degradation of mechanical components in several ways:

- Regular inspection using digital tools like non-destructive techniques (infrared thermography or vibration analysis) allows maintenance teams to identify underlying machinery defects. That way, they can

unearth early signs of wear and tear and rectify them before they cause extensive damage. This is crucial for protecting equipment or systems they are used in.

- Routine cleaning removes dirt and contamination around mechanical motion elements. Cleaning ensures agents accelerating damage of motion components are eliminated from processes.
- Preventive maintenance allows technicians to repair and replace damaged components like seals or worn-out fasteners that can accelerate the degradation of mechanical motion components. For instance, a damaged bearing seal will permit water and debris into the bearing cage. These elements increase friction within the bearing, accelerating its degradation.

Consider using digital tools to streamline preventive maintenance scheduling for mechanical motion elements. Create standard checklists to standardize work and enhance workflow tracking. Train technicians to ensure they conduct accurate maintenance at all times.

3. Operate Assets Within Designed Parameters

Every mechanical component has a designed safety limit beyond which its efficiency and safety are compromised. Operating assets beyond their desired capacities increase their susceptibility to wear and tear, leading to premature asset failures.

Improper asset operation occurs when one:

- Overloads mechanical components like conveyor belts
- Utilizes equipment in the wrong environments
- Operates machinery at extreme speeds
- Exceeds the desired pressure and temperature limits

These conditions exert extra stress and strain on mechanical systems. Surface friction, heat, and additional mechanical stresses cause rapid wear of mechanical components.

Adhering to the designed asset operating parameters ensures machinery is utilized for its intended use. It also guarantees proper loading to keep stress and strain on mechanical elements within acceptable limits. That way, assets cannot struggle to achieve their productivity levels.

Mechanical overloads in a milling facility, for instance, emanating from excess torque, can cause irreversible damage to couplings, transmission systems, gear drives and shafts. The overloads can cause the jamming of mechanical motion elements causing further damage due to increased friction.

Companies should outline specific equipment operating conditions based on the manufacturer's recommendations or design parameters. This prevents overloading or wrong process sequences by operators and maintenance teams. That way, companies can eliminate machinery operating conditions causing increased friction between mechanical moving parts.

Proper equipment operation reduces system vibrations, it also reduces the frequency and severity of unscheduled machinery breakdowns. Rapid vibrations create perfect conditions for the gradual degradation of parts. Emergency breakdowns can create undesirable conditions, like spillage of corrosive fluid media, which can corrode mechanical motion elements. Additionally, maintenance technicians can make errors as they strive to restore assets during emergency breakdowns.

One way to foster proper asset operation is to develop and enforce standard operating procedures. Provide adequate tools and detailed work instructions to ensure employees utilize machinery as intended. Adhering to standard operating procedures eliminates errors that can cause overloading and other undesirable conditions exacerbating wear and tear. Train employees to ensure they understand recommended machinery operating standards.

4. Continuously Monitor Operating Environments

Operating environments have significant impacts on the performance of different mechanical motion components. These components are manufactured from materials with varying physical and chemical properties. Some fabrication materials require strict regulation of environmental conditions.

High temperature, humidity, dust, or corrosive gases can expedite the degradation of mechanical components. Continuously monitoring operating conditions helps companies to identify environmental patterns or trends increasing tear and wear rates.

Companies should monitor the number of abrasive contaminants and develop appropriate control measures.

Monitoring operating environments takes into account:

- **Contamination monitoring:** How many contaminants, such as dust and abrasive debris, are within the working environment? Over time, companies should monitor the number of abrasive contaminants and develop appropriate control measures. Facilities or operations churning out massive amounts of dust can benefit from air filtration systems or dust collectors to protect mechanical motion components.
- **Humidity and corrosion monitoring:** Highly humid environments create perfect conditions for rust on metal components. Companies can utilize dehumidifiers to control the amount of moisture in enclosed spaces. This can reduce premature asset damage through surface corrosion.
- **Temperature monitoring:** High temperature causes thermal stress on mechanical components. Repetitive thermal stresses can lower the efficiency of mechanical motion components since they facilitate the gradual damage of parts. Temperature monitoring can also extend to internal machine parts. Companies can identify assets generating a lot of heat and insulate them or equip them with heat extraction equipment.

Monitor environmental variables over time and implement appropriate mitigation measures before they cause damage.

Invest in relevant industrial sensors, like Internet of Things (IoT) sensors, for real-time monitoring and timely generation of alerts when conditions exceed predetermined levels. Maintain these sensors to enhance their accuracy and durability.

5. Handle Assets Correctly

The way companies handle assets determines the longevity and reliability of mechanical systems. Some practices accelerate the wear and tear of motion components, rendering them ineffective after a short time in service. Facilities require specific procedures for handling, storing, installing, using, and cleaning mechanical motion components. Stocking replacement motion components made from iron or steel in a dusty or humid space causes irreversible surface damage through gradual rusting.

Follow the correct procedures when lifting and transporting mechanical motion components. Use appropriate lifting equipment and hook equipment like motors using eyebolts on its body. Secure these components in the correct packages to protect them from abrasive or corrosive elements during transportation. Do not drop mechanical components from heights to maintain structural integrity and prevent physical damage.

Store mechanical motion components in a clean and dry environment. Indicate on the package if the mechanical parts are fragile. Use the right tools and adhere to recommended procedures during installation. Avoid excessive force when fastening mechanical motion components to avoid breaking, warping, or prematurely damaging them. Verify the alignment of different mechanical parts and check torque specifications when installing or replacing components.

Use appropriate cleaning agents when removing contaminants from assets. Avoid abrasive, tough cleaning tools or chemicals that might distort mechanical motion components or accelerate their degradation.

Final Remarks

Implementing different solutions for minimizing the wear and tear of mechanical motion elements can yield desirable financial savings for any company. Combating wear and tear of mechanical parts enhances their performances, extends asset lifespan, and maximizes occupational safety and health.

Implement best practices and leverage advanced digital technologies to monitor and mitigate equipment degradation. Focus on continuously improving the quality of inspection and maintenance workflows. Collect and analyze equipment performance data to foster a data-driven wear and tear mitigation program, reduce operational costs, and optimize the reliability of mechanical motion components.

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Bryan Christiansen is the founder and CEO of Limble CMMS. Limble is a modern, easy-to-use mobile CMMS software that takes the stress and chaos out of maintenance by helping managers organize, automate, and streamline their maintenance operations.