PRO-RELIABILITY SOLUTIONS

Manufacturing

Case Study

Root Cause Analysis of Grinding Machine Failures

Business Need

The manufacturer produced machined parts for the automotive industry and were experiencing a high number of spindle failures on their fine grinding machines. The spindles were expected to last 6 months before replacement but were currently lasting 1700 hours of operating time.

Solution

It was agreed to initially perform a Root Cause Analysis investigation to determine root causes of failure and identify effective solutions to extend the life of the spindles as suggested by the OEM.

The RCA was carried out onsite over a two-day period:

Day 1 – RCA Preparation and Evidence Collection

- Carry out 'on the job' informal chats with key personnel (team leader, craft person, oil technician)
- Evidence collection from OEM manuals, and spindle failure reports.
- Conversation with local spindle repairer regards recent spindle overhauls
- Develop a timeline of failures
- Agree 'Impact Statement'

Day 2 – RCA Team Facilitation

- Develop the causal factors chart (cause and effect)
- Attach Evidence to causes
- Identify effective solutions to prevent reoccurrence
- Write and issue report

The Root Cause Analysis Methodology

Due to the nature and financial impact of these spindle failures it was agreed to utilise the causal factors approach and the seven steps towards effective Defect Elimination:

1. Select RCA Type – Proactive or Reactive
2. Trigger Point and Risk
3. Complete Impact Statement
4. Develop a Timeline
5. Develop the Causal Tree (5 Why or Causal Factors)
6. Complete the Report
7. Action Tracking

Results

The RCA investigation was completed in 2 days and resulted in the identification of 41 causes and 8 root causes with identified solutions.

The key details from the final report are below.

Impact Statement

Premature failure of grinding machine spindles resulting in production downtime and scrappage of parts.

Safety: *Manual handling risk when spindles changed*

Reliability: *MTBF = 1700 Hours*

Quality: *Increase in waste due to scrapping of manufactured parts*

Frequency: *15 failures*

The Analysis – CF Type

The premature failures of the spindles focused on several different areas around the machine. In conversations with team leaders and machine operators it became evident that the machines are operated on an inconsistent basis and relies on the knowledge and experience of the operator to try and ensure consistent machine operation.

Although there was evidence of TPM activity on the machine with TPM sheets, these did not reflect reality. The TPM checks on the machine such as coolant changes, oil drip checks were no longer being followed as originally described. There was no formal 'spindle commissioning procedure' that was documented and being followed, and no formal spindle installation procedure being utilised.

Another key area for the investigation was associated to the handling and dispensing of the Hydraulic Oil used within the spindle and for the grinding operation. Whilst the spindle incorporates some high precision ceramic bearings which rotate at high speeds, the oil is not being dispensed or treated with any due care and attention, considering the application.

The potential for oil contamination before the oil reaches the spindle bearing, could be significant enough to cause the premature spindle failure without the other contributing root causes identified.

Solutions

Cause	Solution
No installation procedure exists	Develop a procedure for spindle installation with a documented sheet for reference and record.
No daily checks	Develop and perform daily checks. Record findings.
No Lubrication Education	'Lubrication Training' for operators who need to use oil on machinery. **('ICML' Level 1 training for Oil Technician)**
Change of coolant procedure	Verify the coolant change procedure from 3 months to 6 months to on-condition.
Site Lubrication Standards	Introduce a set of Lubrication standards for the control, dispensing and handling of site oils.
Hydraulic Oil Lubrication Issues	Carry out lubrication audit of oil handling and dispensing processes to identify improvements to ensure world class lubrication is being performed.
Incorrect low-level settings	Establish if the low-level alarms are functional and working correctly. Are the alarms fail safe?
Bent Spindle Shafts	Ensure that spindle repairer is performing shaft checks on overhauls. If any damage is detected, then bent shafts must be replaced.

Conclusion

The conclusion from this investigation would be to say that several causes came together over time, which have resulted in the premature failure of the spindles. Some of the causes had existed over time and some of the causes came from every day decisions made during machine operation. The total number of root causes identified equalled eight.

The implementation of the identified solutions against the root causes will reduce losses to production through unplanned outages, increase the spindle life and eliminate product quality non-conformances.

Pro-Reliability Solutions offer Defect Elimination and Root Cause Analysis online and in-house training, plus facilitation support.

Please contact us for further details:

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