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ENDPOINT MP2 TEST PILOT SAVED >$10 MILLION IN DOWNTIME

Over the past four months, GreaseBoss has piloted its Endpoint MP2 on mining excavators and ancillary equipment.

The pilot program successfully prevented major pin and bush failures, saving over $10 million in downtime and repairs. It ensured correct greasing of critical points demonstrated significant ROI for digital lubrication management in mining fleets

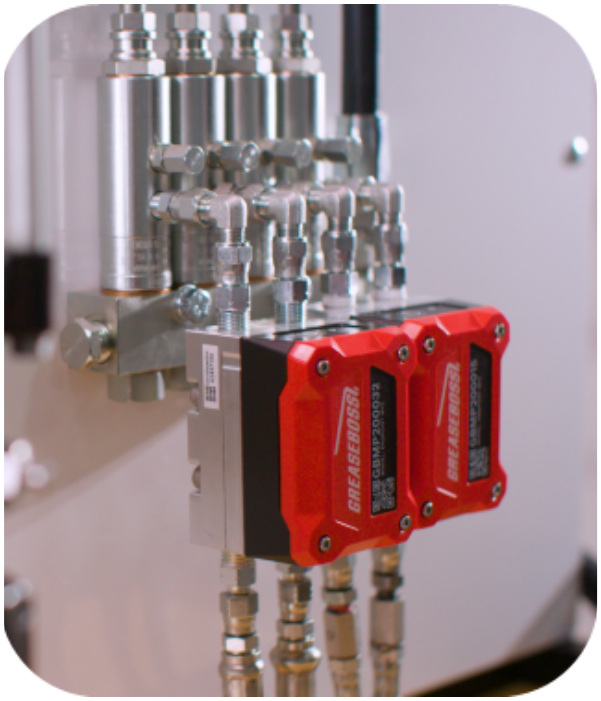
CONTEXT

Since November 2024, the Endpoint MP2 devices have been in **pilot tests at multiple customer sites** on various equipment including:

- **Liebherr 9400,**
- **Liebherr 9600,**
- **Komatsu PC7000, and a**
- **Komatsu D115Axi-8 Bulldozer**

The grease points monitored on the excavators were:

- Boom foot
- Hoist cylinders
- Bucket pins
- H Links
- Slew bearings



SOLUTIONS PROVIDED

The Endpoint MP2 is designed to verify correct grease flow into critical grease points and **detect hose and line breakages.**

This ensures lubrication systems are delivering the right amount of grease to each injection point, **preventing grease-related asset failures** and optimising maintenance processes.

Developed over the past 12 months,

this device is designed to be installed downstream of injectors and distributors, that monitors:

- **Grease flow volume**
- **Line pressure**
- **Temperature**

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MEASURABLE OUTCOMES

DETECTED LUBE PUMP FAILURE DUE TO ELECTRICAL WIRING HARNESS FAILURE

One excavator had a lube pump issue identified within three days of system commissioning.

Of all four critical grease points monitored, **All of them showed the same trends of sporadic grease application** for short periods followed by no grease application for extended periods over the first three days of operation (see Figure 1 & 2).

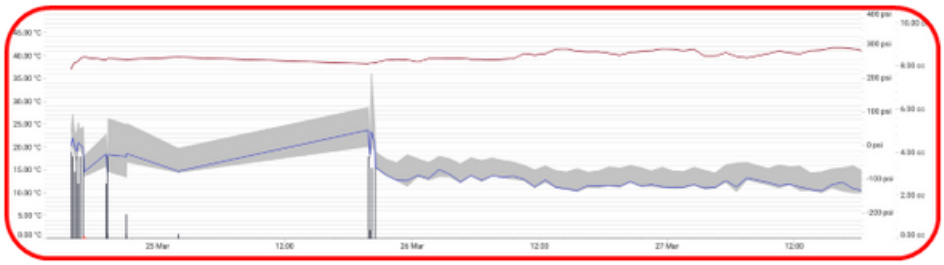

Figure 1 - Boom foot LHS showing a lack of grease applied – the same trend across multiple points

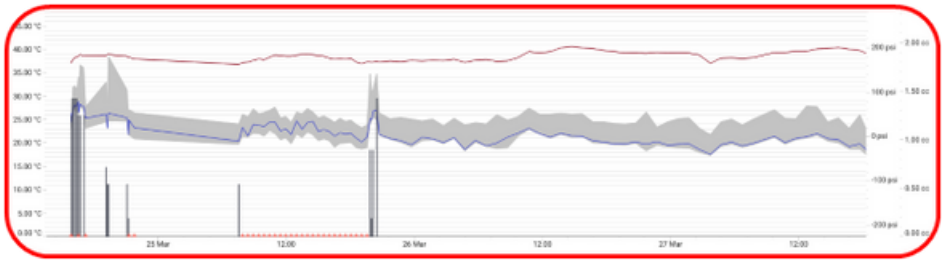

Figure 2 - Boom foot LHS showing a lack of grease applied - the same trend across multiple points

Analysis of this data quickly identified the faulty wiring harness as the issue, ahead of the OEM monitoring system which failed to bring this issue to the attention of the maintenance team.

This issue detection prevented multiple pin and bush failures on the boom foot and hoist cylinder pins - **saving the customer over $10m in downtime and repair costs.**

REVEALED INCORRECT TUNING OF AUTOLUBE SYSTEMS

The data captured by the Endpoints also revealed a mistuned autolube system that caused the left hand side of the boom foot to receive less grease than the right hand side boom foot (refer to figures 1 & 2).

IDENTIFIED INCORRECT GREASE PUMP TIMER SETTING

On one of the assets, the pump cycle timer was identified to be incorrectly set and was firing 1.5 times more often than the design cycle time, **leading to an excavator being overgreased.**

The detailed data captured by the Endpoints enabled investigation into the cause of the over greasing.

Analysis of this detailed data quickly revealed that the grease volumes were correct but the time difference between pump cycles was too short – **quickly identifying the root cause and enabling the issue to be efficiently rectified.**

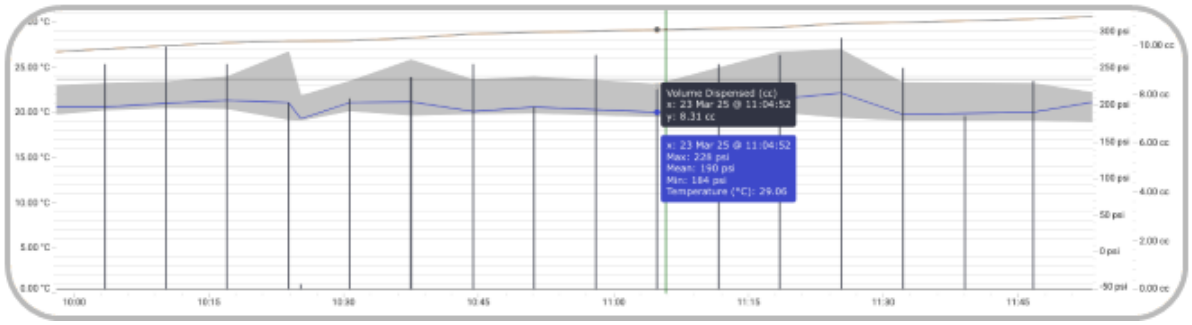

Figure 3 - Detailed grease volume, pressure, temperature and cycle time data

The greasing data, as shown in Figure 3 clearly shows:

- The exact time that each pump cycle occurred
- The exact volume of grease delivered at each cycle
- The minimum, maximum and mean pressure in the grease line at each cycle
- The temperature at each cycle

INDIRECTLY DETECTED FAILED INJECTOR & VALIDATES HEALTHY LUBE SYSTEM

An interesting finding was that the Critical Point Monitoring solution could also detect when a non-critical injector failed, **even when it was not being directly monitored.**

A **"healthy"** lube system will give a **consistent trend** in the injector volumes can be observed across a lube system, as shown in Figure 4.

Figure 4 - Healthy lube system - consistent trends across injectors.

In one of the pilot assets, an injector on a swing box (not monitored directly by Endpoints) failed in bypass. The exact timing & impact that it had on the entire lubrication system is evident in Figure 5.

Figure 5 - Bypassing injector causing inconsistent trends across the system.

Analysing this data **prompted the maintenance team to investigate the lube system**, where the bypassing injector was then quickly found and rectified.

This insight allows customers to monitor critical grease points with certainty and accuracy, whilst still receiving full lube system coverage across the rest of the non-critical points.

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INDIRECTLY DETECTED FAILED INJECTOR & VALIDATES HEALTHY LUBE SYSTEM

The main driver to measure grease line pressure in the Endpoint MP2 is to detect blown hoses downstream of the Endpoint MP2, perfect for monitoring high impact areas such as bucket pins.

Pressure Sensing

The findings of the Endpoint MP2 pressure sensing capabilities throughout the pilots was:

- The devices demonstrated **reliable and consistent pressure monitoring** throughout the pilots.
- The measurement of **min, max and mean pressure for each cycle** was informative and insightful.
- **Pressure readings were affected by temperature fluctuations**, which led to pressure trends changing (see Figure 7 and Figure 8).
- During installation, the calibration of absolute pressure on each flow meter could be adversely affected – leading to incorrect absolute pressures being recorded in some Endpoints (for example measuring negative line pressures ranging between -100 psi and -400 psi) (see Figure 7 and Figure 8).

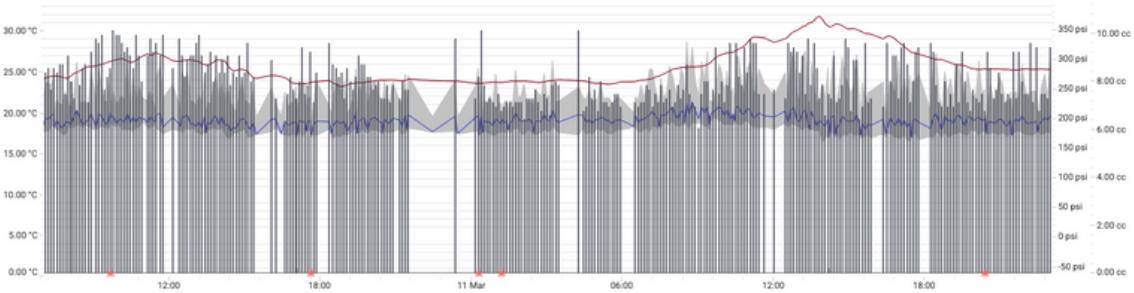

Figure 7 - Consistent pressure levels measured (blue line) while temperature was stable (red line)

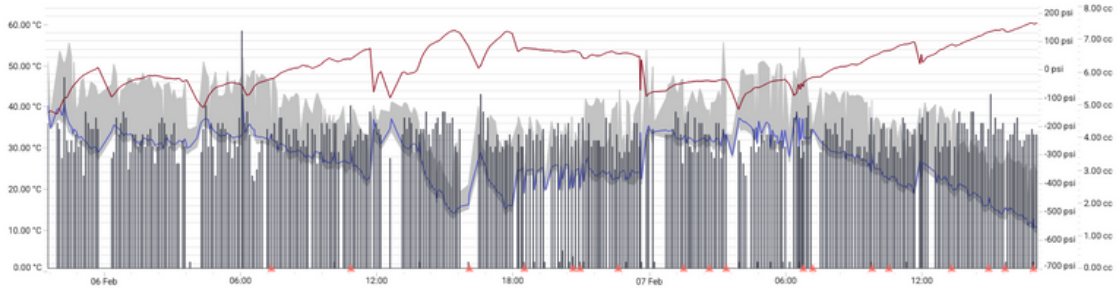

Figure 8 - Pressure readings (blue line) inversely affected by temperature (red line). Absolute pressures affected by calibration impact on installation (reading grease pressures in negative values)

Pressure Alerting

Since no grease hoses blew during the pilots, no pressure alerts were able to be demonstrated during the pilots.

However, The GreaseBoss Cloud has pressure compliance and alerting on a “per pump cycle” basis under development and test. The final design updates will provide consistent and reliable pressure sensing and alerting capabilities, to **alert maintenance teams within an hour of a grease hose blowing.**