

study

ZERO-Downtime on Multi-million dollar Tunnel Boring Machines

case

FPES were contracted to diagnose and fix several hydraulic related problems caused by fluid contamination in the Tunnel Boring Machines.

The Tunnel Boring machines which are used to cut through sandstone and shale are key to the success of Australia's largest public transport infrastructure project; the \$8.3 billion Sydney Metro Rail project. Actively managing and maintaining the health of hydraulic systems on these machines is critical in avoiding breakdowns and construction delays.

Challenges

- Identify root causes of hydraulic system contamination
- Fix and monitor in real time to avoid costly downtime and project delays
- Working within space confinements of tunnelling scenario
- Prevent ongoing issues and maximise equipment performance

Key to finding an effective solution was the ability to deliver diagnostics and work within the confined physical parameters of the tunnel, the TBM and its ongoing operation.

The hostile tunnelling environment is a significant source for contamination to the oil, resulting in operational failures within individual components of the TBMs, causing them to break down, costing time and money to the project. These contaminants blocked the hydraulic systems; pumps were clogged and valves were sticking, which lead to several other operational issues.

The problems caused by the contaminants included:

- blocked orifices in the hydraulic system
- auxiliary thrust pump not able to properly ramp up
- issues with the feeder unloader pump including a constantly sticking priority valve
- clogged main thrust pump
- complete failure of the loaders
- blocked feeder unloader compensator
- sticking proportional valve
- main relief valve blowing off to the hydraulic fluid tank.



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Fluid Power Engineering Solutions was called in with their FluidCare™ program to solve these problems.

The FluidCare™ team were engaged to come up with urgent and innovative ways to keep the TBM operational. As the source of containment was yet unknown, but the effect was obvious, the team designed, manufactured and supplied various filters to protect the vulnerable components.

The FluidCare™ team ran an oil analysis to create an informed diagnosis. Evidence of water was found during the crackle test and an ISO cleanliness level was determined based on critical components and system pressures. Using the determined ISO cleanliness the technicians then selected the most adequate filtration rig.

The rig was strategically connected to the 11,000L reservoir. The inlet was located at the bottom of the reservoir with the return as far away as practical. A Parker icountPD real time particle detector was programmed with the determined ISO cleanliness count. The rig was activated and left running on the machine until the icountPD indicated that the ISO count had been achieved.

Once the purification process was complete the FluidCare™ Technicians improved the tank breathers with desiccant type, insuring only clean dry air entered the reservoir. Continued use of the icountPD was recommended to provide ongoing condition monitoring.

Using proven centrifuge vacuum dehydrator filtration technology and technician experience, Fluid Power Engineering Solutions successfully delivers comprehensive oil purification in parallel to continued tunnelling operations with no downtime to the machine.

Customer Benefits

- No machine downtime
- Monitoring the results in real time
- Ensure no over or under servicing occurs
- Optimising equipment performance
- Guaranteed Savings; reducing operational costs and avoiding project delays



Solution

- Restore oil quality to new, avoiding expensive oil replacement and machine damage
- Kidney loop system purification of the oil using a centrifuge vacuum dehydrator
- Provide tools for ongoing analysis and monitoring solutions
- Preventative maintenance techniques



The process of cleaning the oil, rather than replacing it, had many advantages for Sydney Metro Rail; along with proactively implementing measures to avoid repeat issues.

Utilising the FluidCare™ program ensures a holistic approach to contamination solutions. Cleaning the oil in the reservoir not only cleans the whole system and associated componentry, but also ensures overall system health, performance, machine reliability and equipment life expectancy.

Having a 'no machine downtime' guarantee meant that all productivity could continue on-schedule and consequently provided a huge cost benefit to the project. It is cheaper to remove contaminants from the oil rather than exchanging it, the benefit of purification far outweighed the cost of replacing the 11,000L fire retardant fluid. Monitoring the results in real time also meant that the machines were not over or under serviced, further eliminating unnecessary costs.



A complete program designed to deliver optimum hydraulic equipment performance through proper fluid management.

- **ASSESS** - Identify & Diagnose
- **IMPLEMENT** - Fix & Improve
- **MANAGE** - Monitor & Prevent

- Equipment protection through mobile fleet filtration services purifying to ISO standards
- Real time remote and on site oil condition monitoring
- Guaranteed savings

For more information, visit www.fluidcare.com.au.