

Quick Detachment System Tyre Handler

Glencore – Oaky North Underground

People and vehicle interaction when changing tyres underground

The Problem

The industry has utilised various methods, including multiple versions of tyre handlers, to assist in the change out of tyres in the underground environment. The process has historically presented challenges and safety issues associated with the traditional practice of moving an LHD while an operator lines up the wheel with the hub.

These challenges have increased in recent years, as the underground industry has moved from air-filled to solid-filled tyres. The attendant increase in weight of a tyre and rim assembly has risen from 400kg to 750kg.

Oaky North Underground has designed, developed and implemented a removal and installation system – the QD 900 – that reduces the amount of manual handling required for a tyre change out, the number of personnel needed to carry out the task, and the risks associated with the procedure.

The Solution

Oaky North's QD900 allows the removal and installation of shuttle car and LHD wheel assemblies with limited manual handling.

What's more, it allows the job to be carried out safely by two men instead of four (traditionally), saving labour costs at the same time.

More importantly, it eliminates a potential "crush zone" during the operation.

The QD900 consists of a combination of proprietary and custom manufactured components, which work together to provide 6 ranges of motion: raise/lower, reach, tilt, side shift, horizontal slew and rotation. It's these 6 ranges of motion that are the power behind the QD900: together, they allow wheel assemblies to be removed and reinstalled while the LHD is completely stationary. There is no need to move the LHD to line the wheel up with the hub, removing a potential safety issue.

The project was initiated with Jet Engineering in Mackay and managed by Michael Medway of Newlands Underground (Development Mechanical Coordinator). The implement was trialled at Newlands Underground and modifications made based on user feedback. A management of change process with associated risk assessment was conducted before implementation.

Benefits/Effects

The specific benefits for Oaky North are the fitters have a reduced manual handling requirement when changing tyres plus there is a decrease in the overall delay when changing the tyre.

- The QD900 grips the wheel inside the rim instead of outside the tyre, providing two major benefits:

- ♦ It's perfectly suited for use on machines with limited clearance between the tyre and the wheel arch (eg. shuttle cars)
 - ♦ In addition to solid filled tyres, it can also be used on pneumatic tyres – even when they are flat.
- The QD900 features a high quality, Danfoss proportional valve bank. This provides the operator with precise control, speeding up the process of aligning the wheel with the hub, and reducing the risk of damaging wheel studs. As an option, the valve bank can also be operated by remote pendant control.
 - The valve bank features an integrated Deadman function to ensure two-handed control. This keeps operators clear of hazards, and provides compliance with the highest standards of safety.
 - The hydraulic circuit on the QD900 includes a priority flow control valve which guarantees that functions operate at consistent speeds, regardless of the hydraulic performance of the LHD that is providing power.
 - The QD900 features load holding valves on all critical circuits, preventing unplanned movement in the event of hose failure.
 - In addition to load holding valves, the clamping circuit also includes an accumulator which guarantees that clamping force is maintained until it is intentionally released. Clamping force can be monitored via the clamp pressure gauge. This gauge features a coloured band, allowing the operator to determine if clamp pressure is adequate at a glance.
 - The QD900's unique gripping system is selfcentring, and thereby eliminates radial movement when rotating the wheel. This ensures that the tyre will not impact the wheel arch during rotation.
 - The QD900 has 360° endless rotation in either direction, which makes it quicker and easier to align the wheel and the hub, and eliminates the requirement to re-grip the wheel
 - The QD900 comes with RPEQ certification for a WLL of 900kg. This accommodates all of the solid-filled tyres commonly used in underground coal mines
 - All hydraulic hosing is manufactured and tested in accordance with MDG41 , ensuring compliance with the highest standards of safety
 - The QD900 features an emergency stop that connects back to the LHD. This allows the operator to remotely shut down the LHD in the unlikely event of an emergency situation occurring.

Transferability

The QD900 tyre handler can be utilised in all underground tyre changing circumstances as well as surface workshops. There is currently a unit in operation at Oaky North Underground.

Innovation

The end result is a highly innovative machine that improves safety by reducing risks to mine operators.

It is simple to use, reduces the number of operators required for the task,

and is robust enough to withstand the harsh underground environment.

It overcomes the shortcomings, and removes potential safety issues, associated with use of existing QDS tyre handlers.

SPECIFICATIONS / FEATURES

- Tare Mass: 1600kg
- WLL: 900kg
- Ranges of Motion:
 - Raise / Lower - 610mm
 - Reach - 600mm
 - Tilt - Up 3.2°, Down 4.2° (from horizontal)
 - Sideshift - 200mm (100mm either side of centre)
 - Slew - 30° total (15° either side of centre)
 - Rotation - 360° endless rotation in either direction
- Deadman feature to ensure two handed operation
- Emergency stop valve to shut down LHD
- Tyre is gripped inside the rim, to ensure operator safety
- LHD stays completely stationary while operating tyre handler

OPTIONS

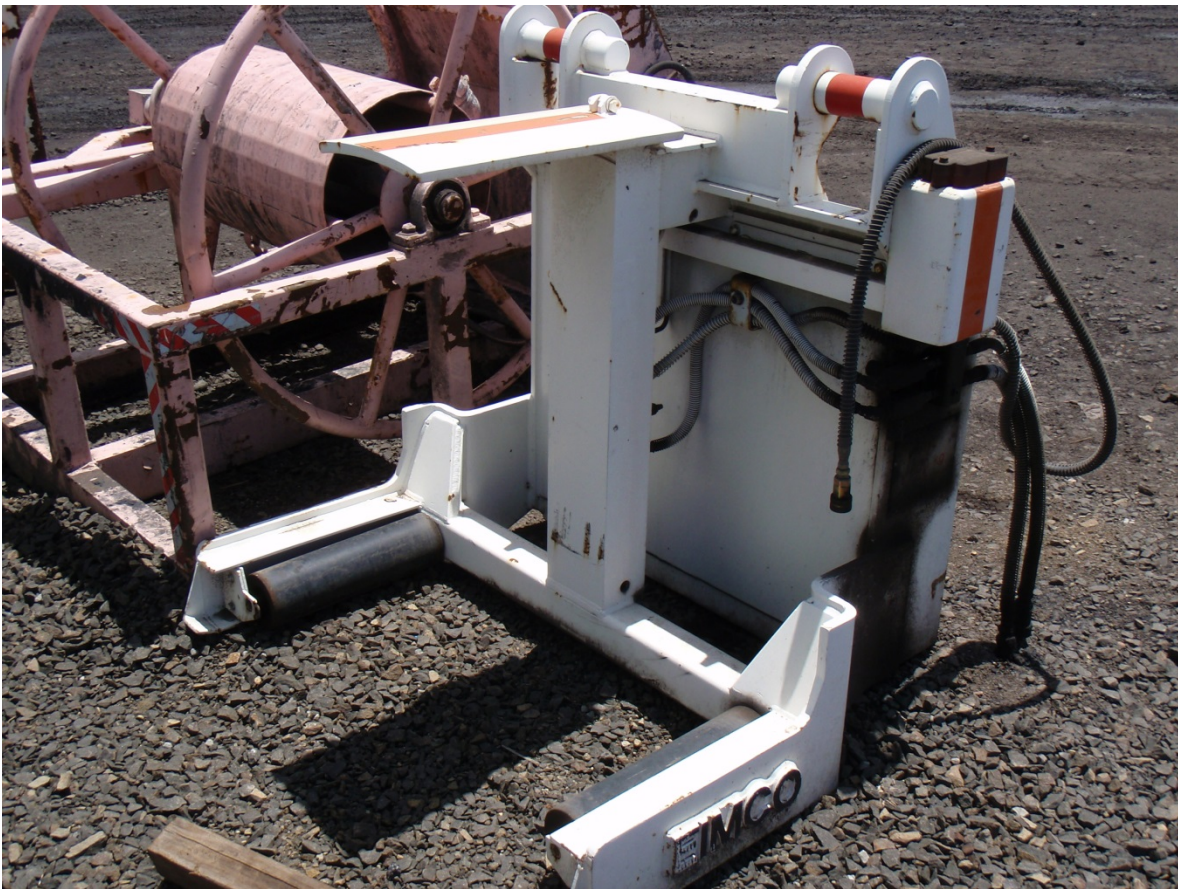
- Modification for use with rig throttle on LHD (bolting mode)
- Interchangeable jaws to suit different wheels (Joy and Warracar Shuttle Cars, Various LHD's, IT28, etc)
- Adapter for installing wheel units

Approximate Costs

The cost to design and manufacture the first unit was \$150,000 and can be purchased through Jet Engineering in Mackay.

OAKY CREEK COAL

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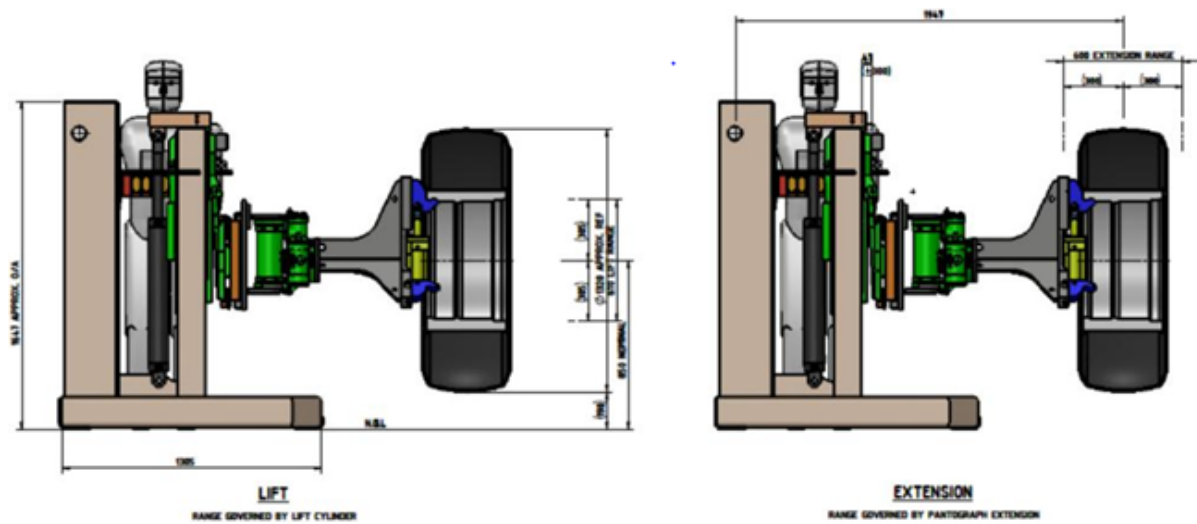
Picture 1: The original QDS tyre handler at Newlands Underground



Picture 2: The new QDS tyre handler currently in use at Oaky North Underground



Picture 3: The QDS tyre handler positioned on a LHD ready for use with a shuttle car



Picture 4: The design dimensions of the QDS tyre handler