

T282C Hytorc Reaction Post Set

Thiess

The Problem:

Using Hytorc bolting tools to torque (rotation) up major components on heavy mining equipment, such as control arms, can expose personnel to several safety risks.

Thiess' maintenance team at the Lake Vermont Coal Project removes, refurbishes and re-installs at least one Liebherr T828C control arm a month due to general wear and tear across the fleet. The process involves removing the arm (approximately 900kg), installing new bushes and re-assembling it onto the chassis.

To minimise potential risks, personnel follow specific controls. Two personnel wearing personal protective equipment (PPE) are required to complete the task. One operates and controls the Hytorc bolting tool, while the other holds (timber) packing as a reaction post for the Hytorc reaction arm to operate against.

The team identified a number of risks and opportunities for improvement to this process, including:

- Eliminating the potential for personnel's exposure to the line of fire when holding the reaction packing for the Hytorc reaction arm
- Eliminating the potential for incorrect manual handling techniques when holding the reaction packing for the Hytorc reaction arm
- Increasing team efficiency by reducing the number of personnel required to complete the control arm refurbishment task

The image below shows the original refurbishment process using the timber packing blocks as a reaction post. A not fit for purpose solution, an additional fitter is required to support the blocks - sometimes using a crow bar.



The image below shows an inadequate reaction point being used to remove a top control arm bolt. This reaction point has the potential to slip during the removal process.

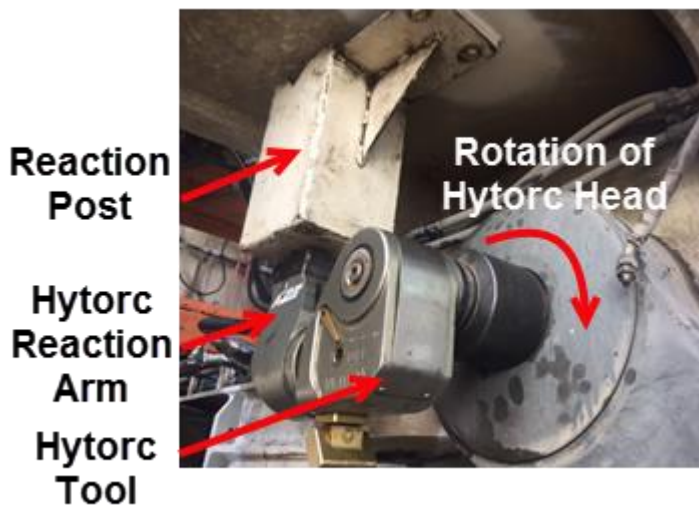


The Solution:

To address each problem, the team scoped, designed and fabricated a set (two) of fit for purpose Hytorc Reaction Posts. Two designs were required due to the way the reaction posts need to be mounted on the chassis to remove the top and then bottom bolts around the reaction arm.

The two posts consist of a series of 12mm thick G250 mild steel plates that provide a flat and structurally stable surface for the Hytorc reaction arm to operate against, eliminating the need for someone to hold the timber packing.

Fabricated and trialled on site, the reaction posts are physically bolted to the truck chassis at the start of the refurbishment process. The Hytorc tool is then positioned on each bolt and the Hytorc reaction arm is mated flush against the reaction post to provide a stable structure for the Hytorc to operate against as shown in the image below of one post design.



The hierarchy of control was applied in the following manner:

Elimination

- Elimination of the reaction post all together was not a feasible solution

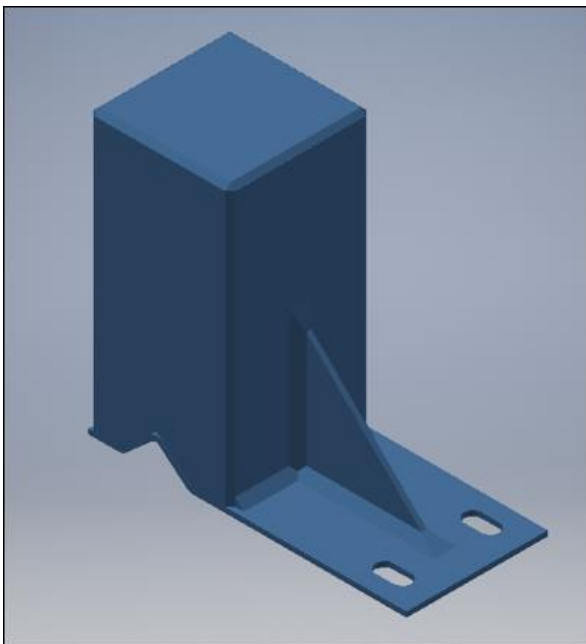
Substitution

- Substituting the inadequate reaction packing with a permanently engineered design was the most suitable option.

Engineering:

- The design and specifications of the Hytorc Reaction Posts have been drawn up and certified by a third-party engineering company.
- Finite Element Analysis (FEA) was incorporated as part of this certification process

The image below shows the certified design drawings for the two Hytorc Reaction Posts. The design displayed below is used when removing the bolts on the lower control arm. Another design is used when removing the bolts on the upper control arm.



Benefits/Effects:

A range of benefits were able to be realised from implementing the Hytorc Reaction Posts, including:

- Development of a tool that is more fit for purpose
- Eliminating the potential for personnel's exposure to the line of fire (if the procedure was not followed correctly) as the reaction posts have removed the need for a fitter to hold the timber reaction packing used in the original process
- Eliminating the potential for incorrect manual handling techniques when holding the timber packing
- Increasing team efficiency. The overall task duration still takes the same amount of time (approximately 30 minutes), however it now requires just one team member, not two, to complete - doubling efficiency
- Improving accuracy by making it easier to achieve the appropriate torque (rotation) specifications

The image below shows just one tradesman completing the Hytorc reaction arm refurbishment process using one of the Hytorc Reaction Posts to remove the bolts at the bottom of the control arm.



Transferability:

The innovation is highly transferrable to other Liebherr T282C, and has the potential to be adapted for use on other Hytorc hydraulic equipment. A design update is currently underway which aims to provide a fit for purpose reaction post that can be used for many maintenance scenarios, not just the T282C control arm refurbishment process.

The Thiess-designed Hytorc Reaction Post Set can be used on any Liebherr T282C Rear Dump. The team is also looking into how these first designs can be adapted for use in other scenarios where Hytorc hydraulic tooling is required. They aim to develop a multi fit for purpose tool that can be used across many scenarios, not just for T282C control arms.

The updated design aims to deliver similar safety and efficiency benefits, namely:

- Eliminating personnel from the line of fire
- Eliminating the risk for incorrect manual handling techniques
- Increasing team efficiency by reducing the number of personnel required to complete tasks.

Innovation:

The set of Hytorc Reaction Posts are an industry first as there were no other fit for purpose products available on the market when the team first developed the idea. Hytorc currently have some small reaction, task specific tools, but nothing suitable for tasks the size and scale required at the Lake Vermont Coal Project.

Drawing on the combined knowledge and experience of the onsite fitters, engineers, boilermakers and safety personnel the team has delivered a relatively low cost, practical innovation that has made our mining operations safer and smarter and will continue to deliver future benefits. The onsite Liebherr representative was also involved throughout the design and execution stages of the project.

The Hytorc Reaction Post Set has improved safety conditions, delivered team efficiencies and inspired personnel to challenge business as usual activities. The initiative has produced a fit for purpose tool that has eliminated the line of fire risk for personnel and doubled team efficiency by halving the number of personnel required to complete the refurbishment task.

The multi-disciplinary approach to identifying the problem and delivering the solution is testament to the commitment by everyone on site to providing a safer work environment for all personnel.

Approximate Cost:

Minimal financial investment has been required to develop the Hytorc Reaction Post Set innovation. It has been scoped, designed and fabricated by the onsite team.

The innovation is and will continue to deliver ongoing financial benefits for the Lake Vermont Coal Project by reducing the number of personnel required to complete the task to just one, not two fitters. The second fitter, originally required to hold packing for the Hytorc reaction arm to operate against, is now available to be reassigned to other maintenance tasks on site.

A breakdown of the costs to date to design and develop the reaction post are included below:

Cost Component	Cost	Notes
Materials (per unit)	\$80	Per Reaction Post
Labour (Boilermaker)	\$175	2 hours
Labour saving (Fitter)	\$43.75	30 minutes per job
Total Annual Labour Saving	\$1,050.00	Each truck twice a year (left and right side)