NSW GOVERNMENT

NSW Resources Regulator

INVESTIGATION INFORMATION RELEASE

DATE: 15 May 2019

Worker injured releasing jammed conveyor chain

Incident date: 5 February 2019

Location: Springvale Colliery, Lithgow, NSW

Overview

A shearer operator was injured in the process of releasing a jammed armoured face conveyor (AFC) chain using the shearer on a longwall. The injury occurred when an eight-tonne working load limit (WLL) Rud link, located on the shearer ranging arm, failed due to overload. The shearer operator was hit on the leg by recoiling components of the tow rope assembly when the Rud link failed. The worker was in the roof support walkway at the maingate end of the longwall, approximately 22 metres (15 roof supports) from the failed connection point on the shearer.

Figure 1: Location of worker struck by the recoiling shackle and blue Amsteel® rope

The mine

Springvale Colliery is an underground coal mine located in the western coal fields near Lithgow in NSW. This mine uses longwall extraction methods.

The incident

Prior to the incident, the AFC had a flight bar jammed in the lower pan race. The AFC chain had possibly been damaged during the work process to un-jam the chain. Three workers were tasked with inspecting the AFC chain for damage. The inspection task required running the AFC chain in reverse

The tailgate hydraulic slow runner drive on the AFC was not operational at the time, and it was determined the maingate drive slow runner would be operated in reverse and the shearer would assist by pulling the AFC chain from the maingate drive.

The towing assembly was created from a range of lifting and towing components available at the mine. The towing assembly was connected to an 8t WLL Rud link located on the shearer ranging arm. The towing assembly consisted of a bow shackle (35t WLL), Amsteel® Blue Rope (139t breaking strength), two 'Recover Fast' Kevlar tow strops in parallel (50t breaking strength each) and large hooks connecting to the AFC chain.

One worker was positioned to observe the AFC chain adjacent to the maingate drive drum. Another worker operated the maingate slow run drive near roof support number 4. The shearer operator was standing near roof supports 5 and 6 in the walkway.

Shortly after the load was applied to the towing assembly by the shearer, the Rud link failed, the bow shackle and rope recoiled back towards the three workers located at the maingate. The bow shackle struck the shearer operator on the lower right leg. The connection point on the shearer was located approximately 22metres (15 roof supports) from where the injured shearer operator was located.

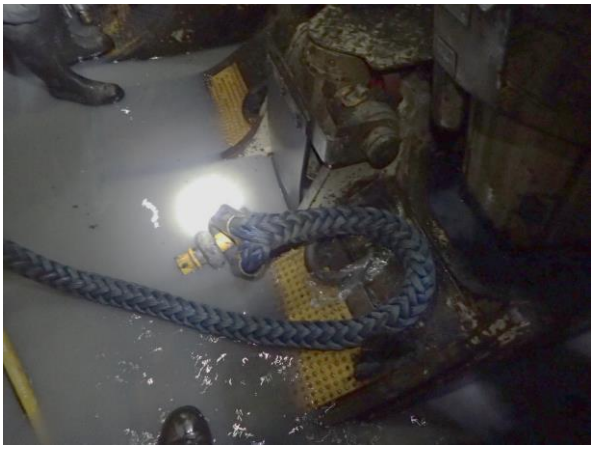

Figure 2: The 35t WLL bow shackle and blue Amsteel® rope on the roof support pontoon

The investigation

The NSW Resources Regulator attended the mine site the day after the incident and conducted an initial assessment. Further investigation has identified the following:

- A night shift deputy created a job safety analysis (JSA) for the AFC chain towing task on the night shift prior to the incident shift. This JSA was not used by the workers on the day shift.
- The night shift crew used a smaller diameter Amsteel® rope assembly for the task. The Amsteel® rope failed and was not reported or investigated through the mine's incident reporting systems.
- On the day shift prior to the incident, there was a failure of a 'nip' chain used to assist the withdrawal of the jammed AFC flight bar. The 'nip' chain failure was not reported or investigated through the mine's incident reporting systems.
- After the AFC chain had been released, three other day shift workers were given instructions to inspect the AFC chain at the maingate drive. The workers carrying out the inspection task using the shearer did not know the tractive effort (force) of the shearer. The workers did not limit the tractive effort of the shearer by isolating one of the two traction motors. The maximum tractive effort of the shearer was rated at 56.4t.
- The 8t Rud link connection point on the shearer was the weakest link in the towing assembly system.
- The 8t Rud link was provided by the OEM to lift the shearer ranging arm.
- The use of the Rud link for the task was not authorised by senior mine management.
- A safe work procedure or JSA was not used in undertaking the task.
- The three workers involved in the task had not completed training in the underground lifting and slinging course as required by the mine's safety management system.
- The three workers were not provided with adequate information and instruction for an appropriately engineered system for the towing assembly.

Investigation of the Rud link failure

In early 2019, a metallurgical inspection was conducted by Bureau Veritas to establish the failure modes of the 8t Rud link at Springvale Colliery. The following key findings have been extrapolated from Bureau Veritas' report 'Fractured Rud Bolt-on Lifting Point[1]'.

[1] Bureau Veritas, Fractured Rud Bolt-on Lifting Point (17 April 2019), unpublished

- The Rud link was as Rud VLBG, 8t lifting capacity with an M36 Property class 10.9 bolt.
- The Rud link had fractured transversely at two diagonally opposite corners. (refer figures 3 & 4)
- Both fractures exhibited overload fracture over the entire fracture surface. There was no evidence of fatigue or other pre-existing cracks on either fracture surface.
- The Rud link failed in a single tensile loading event in a ductile manner. The direction of deformation of both arms, combined with twisting deformation observed on the longer arm was indicative of a sideways, twisting load. The bolt exhibited bending deformation also indicating off-axis loading. (refer figure 5)
- The presence of both tensile and rotational loading suggests the clamp assembly was restrained and prevented rotation of the lug during the loading event, resulting in off-axis loading, which in turn led to increased, resolved loading and overload failure.
- The bolt on lifting point assembly was designed to rotate about the bolt as well as the lug to pivot through 180°. However, the OEM recommends that the lifting lug not be pivoted back over the bolt and clamp assembly or that the assembly not be rotated while loading in a direction parallel to the bolt axis. (refer figure 6)

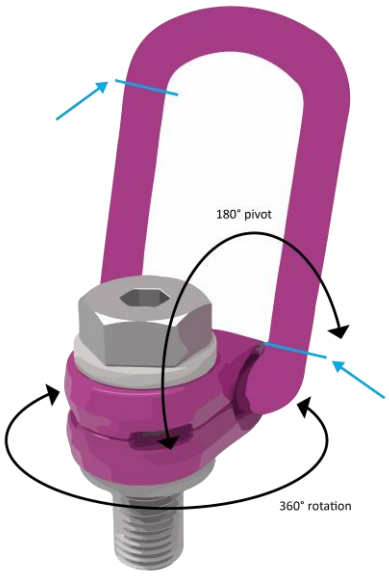

Figure 3: Similar Rud bolt on lifting point. Location of fracture indicated by blue arrows

Figure 4: The failed incident 8t Rud link (source NSW Resources Regulator)

Figure 5: Direction of loading to cause deformation observed

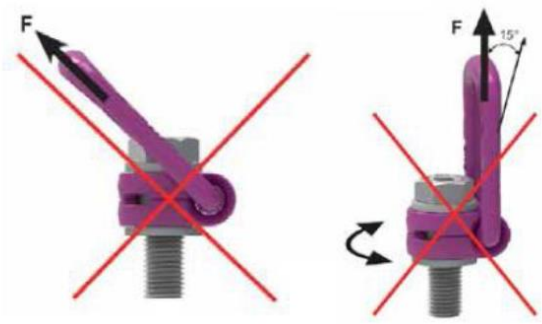

Figure 6: Lifting configurations not recommended by Rud (source Rud website)

Recommendations

The NSW Resources Regulator recommends the following:

1. Mine operators should review their lifting and towing equipment management plans to ensure all activities using lifting and towing equipment are appropriately addressed, including non-routine towing activities.
2. Mine operators must provide adequate information, training and instructions to protect workers from risk while carrying out lifting and towing tasks.
3. Mine operators should seek the appropriate engineering advice in the design and selection of equipment when conducting complex lifting and towing tasks.
4. When planning a task involving lifting or towing, the rating and yield load of all components, including the connection points, must be considered in the design of the lifting or towing system. Additionally, the structure supporting the connecting point should also be considered.
5. People designing towing (pulling or snigging) activities must know and understand the maximum forces capable of being applied to the system, such as tractive effort or weight force.
6. Safe standing zones must be established to account for component failures within the system.
7. Mine operators should review SA04-09 Broken chain connector results in serious injuries

NOTE: Please ensure all relevant people in your organisation receive a copy of this investigation information release and are informed of its content and recommendations. This investigation information release should be processed in a systematic manner through the mine's information and communication process. It should also be placed on the mine's common area, such as your notice board where appropriate.

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AMENDMENT SCHEDULE		
Date	Version	Amendment
15 May 2019	1	First published
17 July 2020	2	Figure 3 updated with new Rud link image