

HAYKA Engineering - REEL SAFE HYDRAULIC LOGIC BLOCK

Provisional Patent #2015900745



HAYKA Engineering 2015

SHUTTLE CAR CABLES - DOCUMENTED HAZARDS & HIGH POTENTIAL INCIDENTS

Shuttle car cable hazards— underground coal mines

Background

Shuttle cars receive coal from the continuous miner and transport it to an underground loading point, such as the 'boot end' of the mine belt conveyor system, before returning to the continuous miner. Shuttle cars are usually powered through a 1000- or 1100-volt electrical reeling cable; an on-board hydraulically powered cable reeler is used to reel and un-reel the cable as needed.

The cables are protected by electrical relays that isolate power in the event of earth leakage, short circuit, or when the cable earth conductor breaks. The cables have heavy-duty insulation and must comply with Australian Standards for trailing and reeling cables.

Hazards

Recent high potential incidents reported to the Mines Inspectorate have highlighted some of the hazards associated with shuttle car cables, including:

Electric arcing resulting from cable damage— this has the potential to ignite methane gas or start a fire in coal dust or surrounding equipment.

Electric shocks and burns to people as a result of direct contact with exposed live conductors in the cable, and indirect contact—touching shuttle car parts that have become energised because of a fault.

Other bodily injuries resulting from the manual handling of cables, or accidental contact with moving cables.

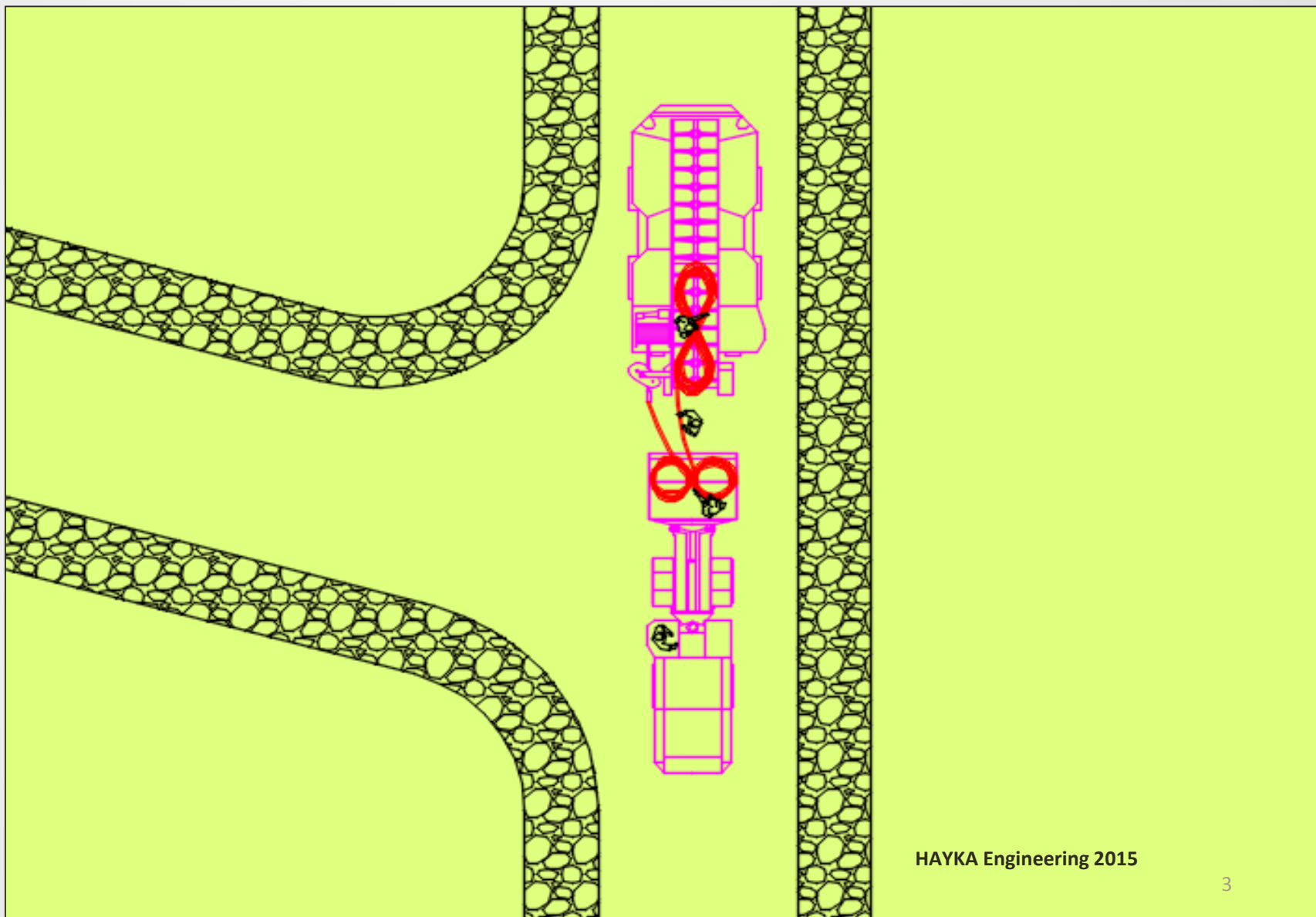
Discussion

High potential incidents involving shuttle car cables at underground coal mines over the past 12 months include:

- An arc flash was reported when a shuttle car ran over its own cable. At the time the car was backspooling (the cable anchor point was behind the car), resulting in the cable entering and leaving the cable reel at a sharp angle.
- An arc flash was observed when a shuttle car ran over its cable. The car was reversing and the cable was pulled in front of the machine.
- A shuttle car cable was damaged when it got caught on a large piece of rock on the road and was then driven over.
- Driving away from the conveyor boot end, a shuttle car veered into the coal rib, pinching and damaging the cable. It resulted in a small flame that self-extinguished.
- A shuttle car cable was cut in half when the car jammed it against the coal rib. The electrical protection tripped and isolated power to the damaged cable.
- A shuttle car cable got pinched between the boot end and the car, causing an electric arc. At the time the car had been backspooling to the boot end (the anchor point was just behind the car when it was at the boot end).
- A person was helping to reel a cable onto a shuttle car cable reeler. The reeler was going too fast and he tried to slow it down with his hand. His thumb got caught in the reeler and was lacerated.
- A shuttle car cable reeler mechanism became clogged with coal fines and jammed, causing the car to run over the cable. There was no visible damage and no arc flash was reported.

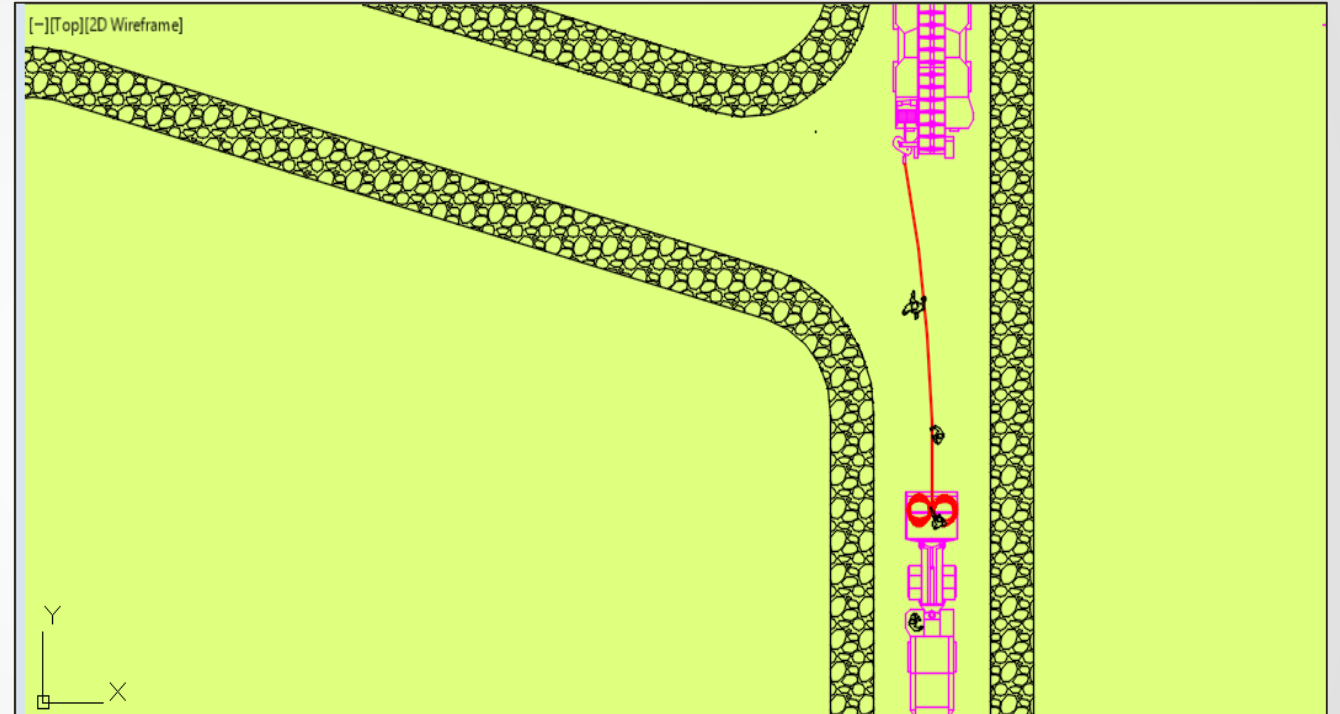


CONVENTIONAL CABLE HANDLING



CONVENTIONAL CABLE HANDLING

- When manually handling cable 3-4 men are required, 1 men to operate the LHD and 2-3 men to loop & feed the cable into the cable pod of the LHD.
- The operator has very poor sight of the men working in front of the LHD.
- The task is high risk in regards to manual handling, slips trips & falls, poor communications & cable damage with the risks becoming increasingly greater in poor conditions.

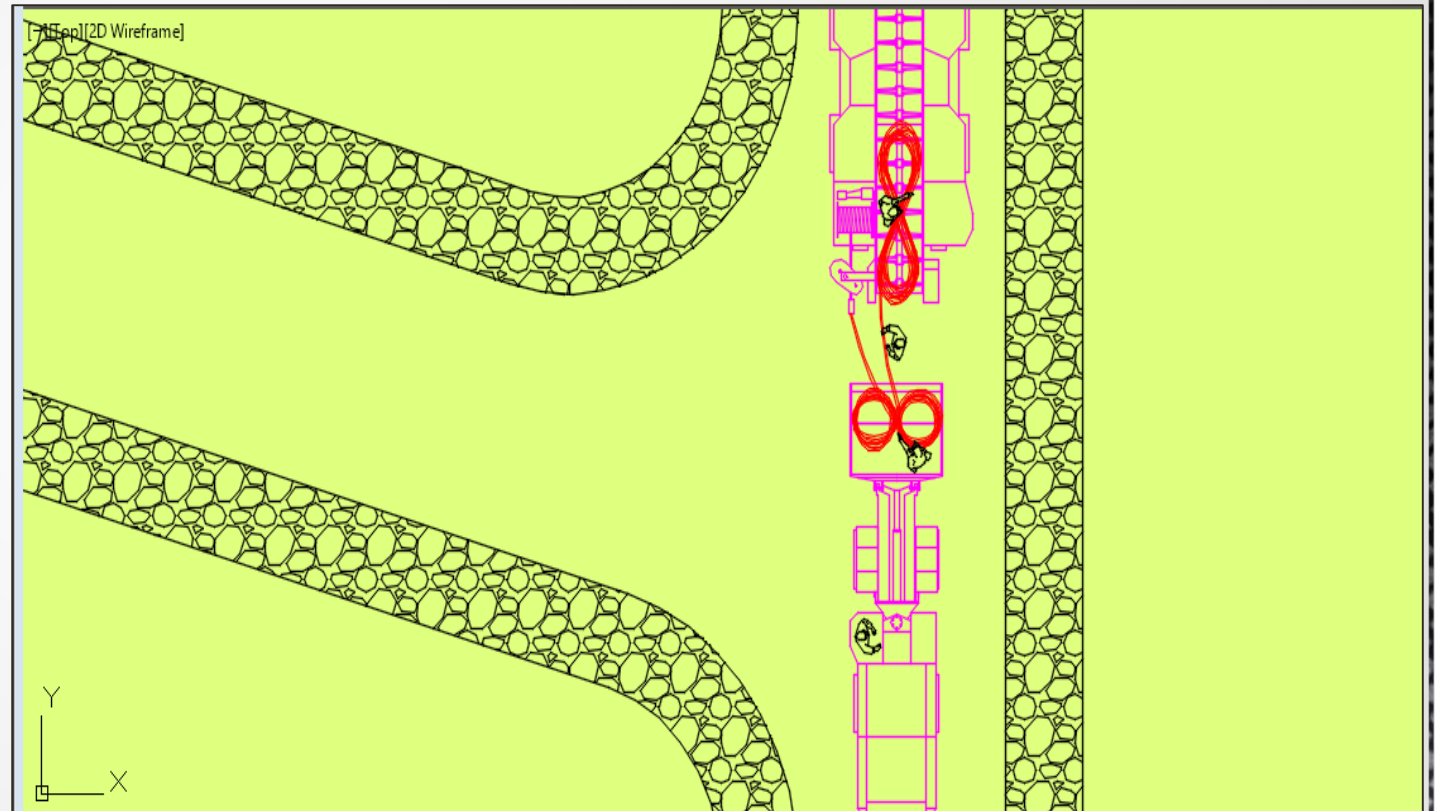


UNLOADING CABLE

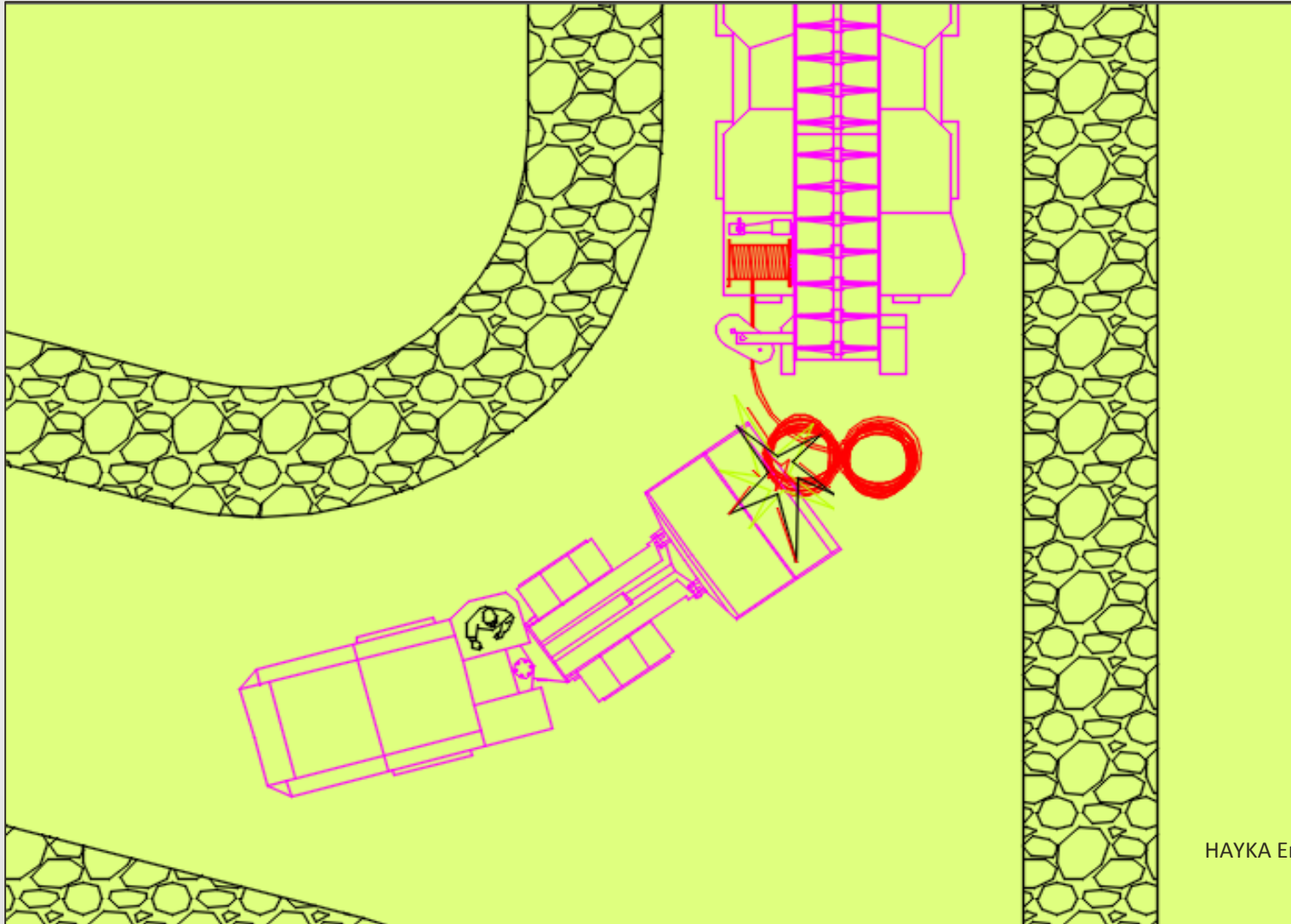
Once the LHD has reached the S/car, the cable is then unloaded out of the cable pod then into the throat of the car. This is the preferred method

Other methods to storing the cable include:

- 1) The cable can be left in a Cable pod at the front of the car.
- 2) The cable can be coiled on the ground in front of the car. Both these methods are prone to cable damage.



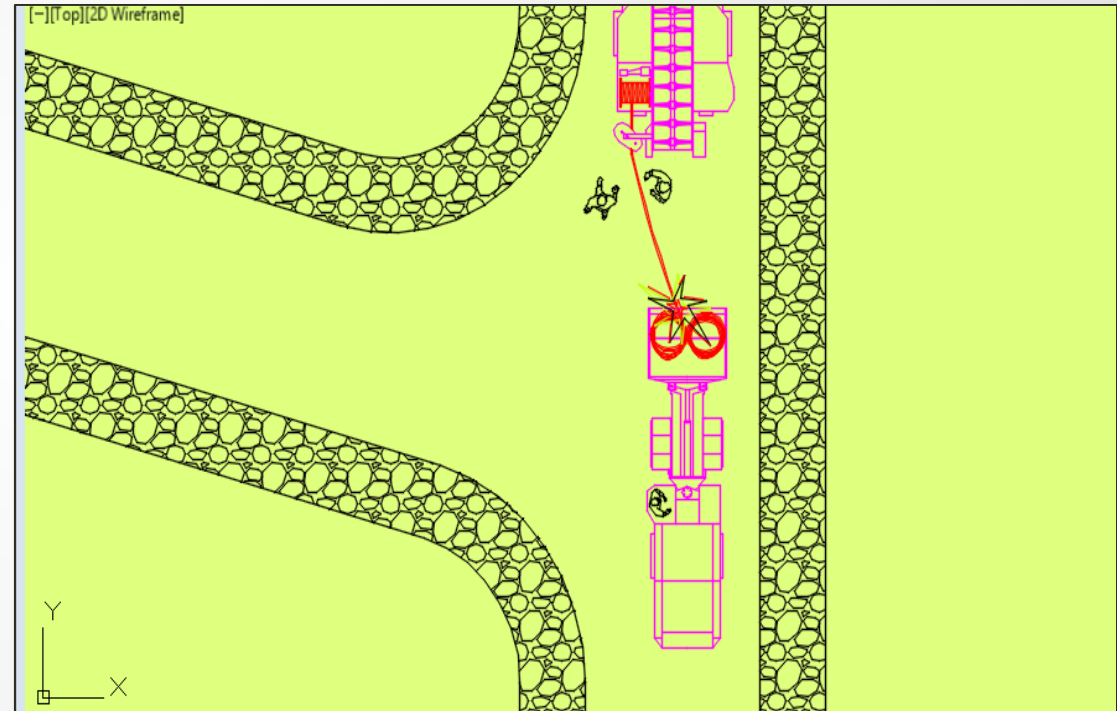
CABLE DAMAGE DURING BELT MOVE



-CABLE DAMAGE- WHILST LOADING INTO cable pod

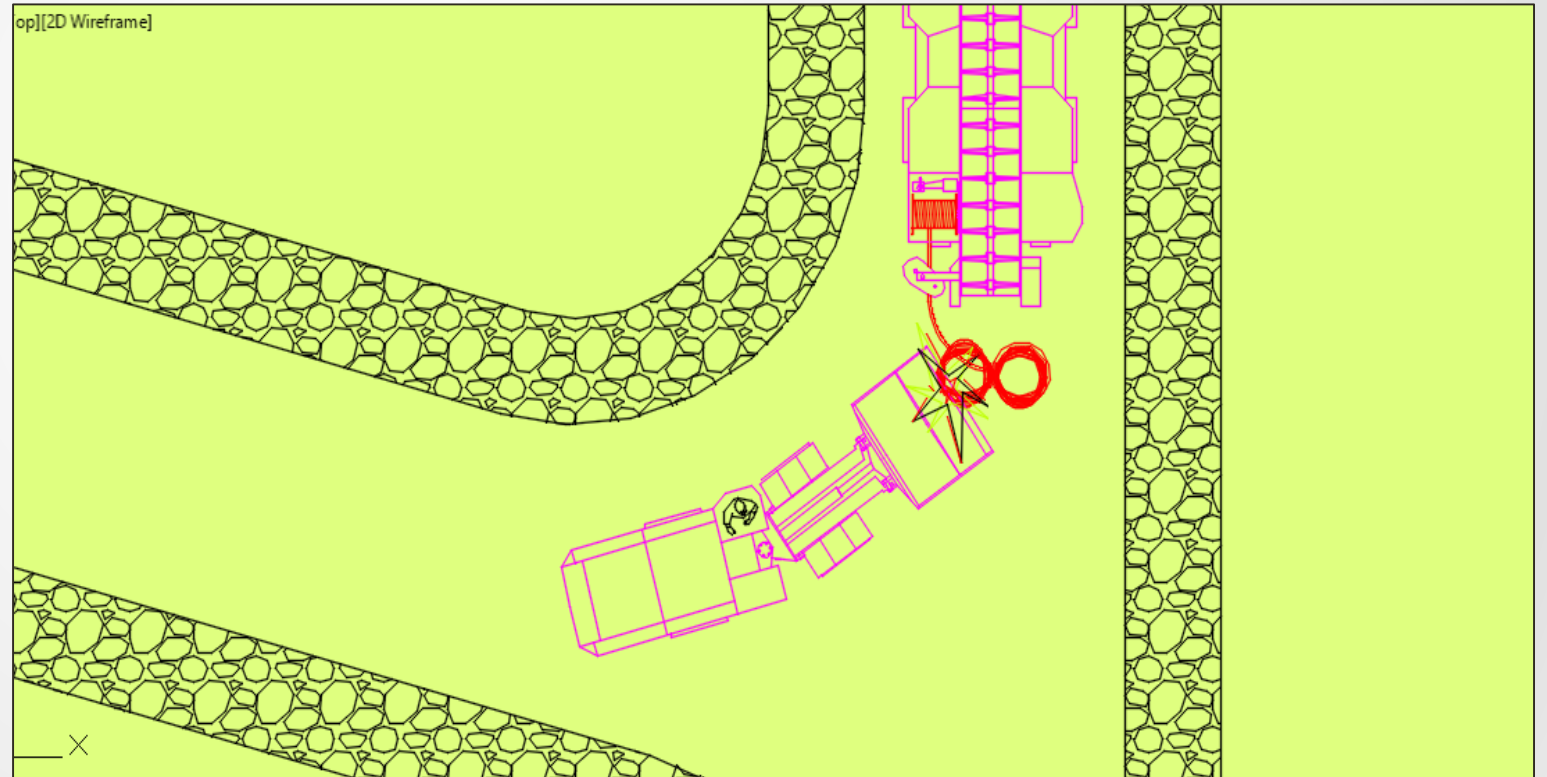
- This form of cable damage is the most common of the three. This occurs when the operator keeps on rolling forward in the LHD, creating slack rolling the cable under the cable pod & the cable pod then pinching it.

- The result is that the car will not power up at the end of the belt move due to lost earth continuity, with the outcome been a \$12,000 cable repair & generally the panel been down for around 4-5hrs while the cable is been sourced & then replaced. therefore production been lost.



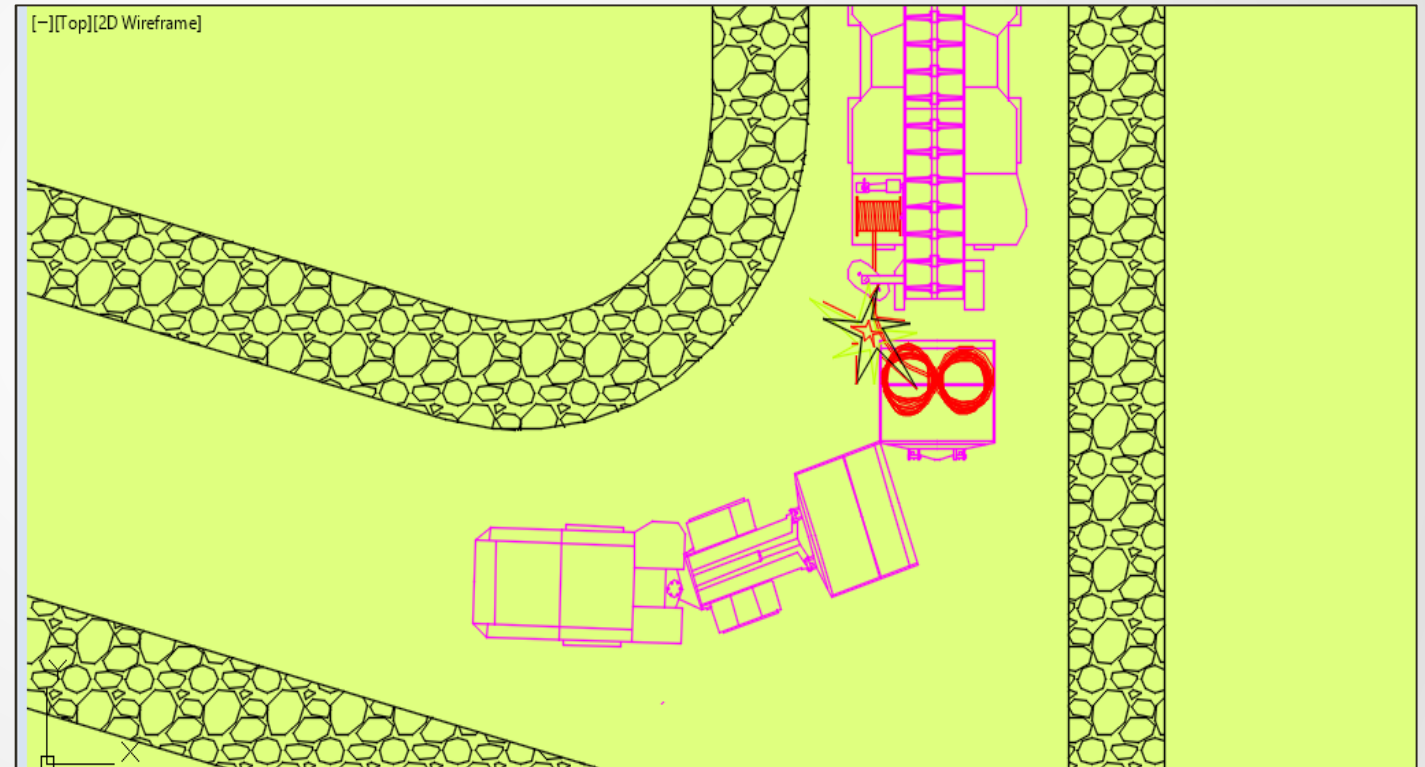
- CABLE DAMAGE – DUE TO BEEN LAYED OUT ON THE GROUND

- This is also a common case of cable damage due to the lack of concentration by the operator & poor visibility. Black cable on black floor is very hard to see if not flagged off.



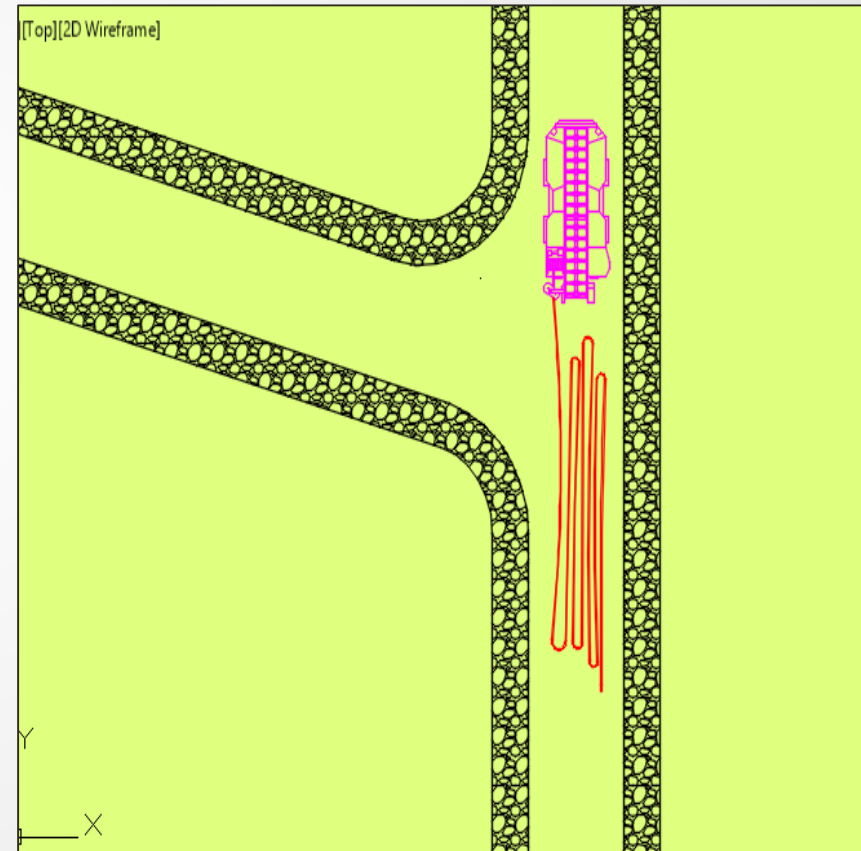
-CABLE DAMAGE- DUE TO BEEN SET DOWN IN CABLE POD

- The cable pod can be clipped by the LHD with the cable rolling under the cable pod once again pinching it.



UNLOADING CABLE, RE-SPOOLING & ENERGIZING S/CAR

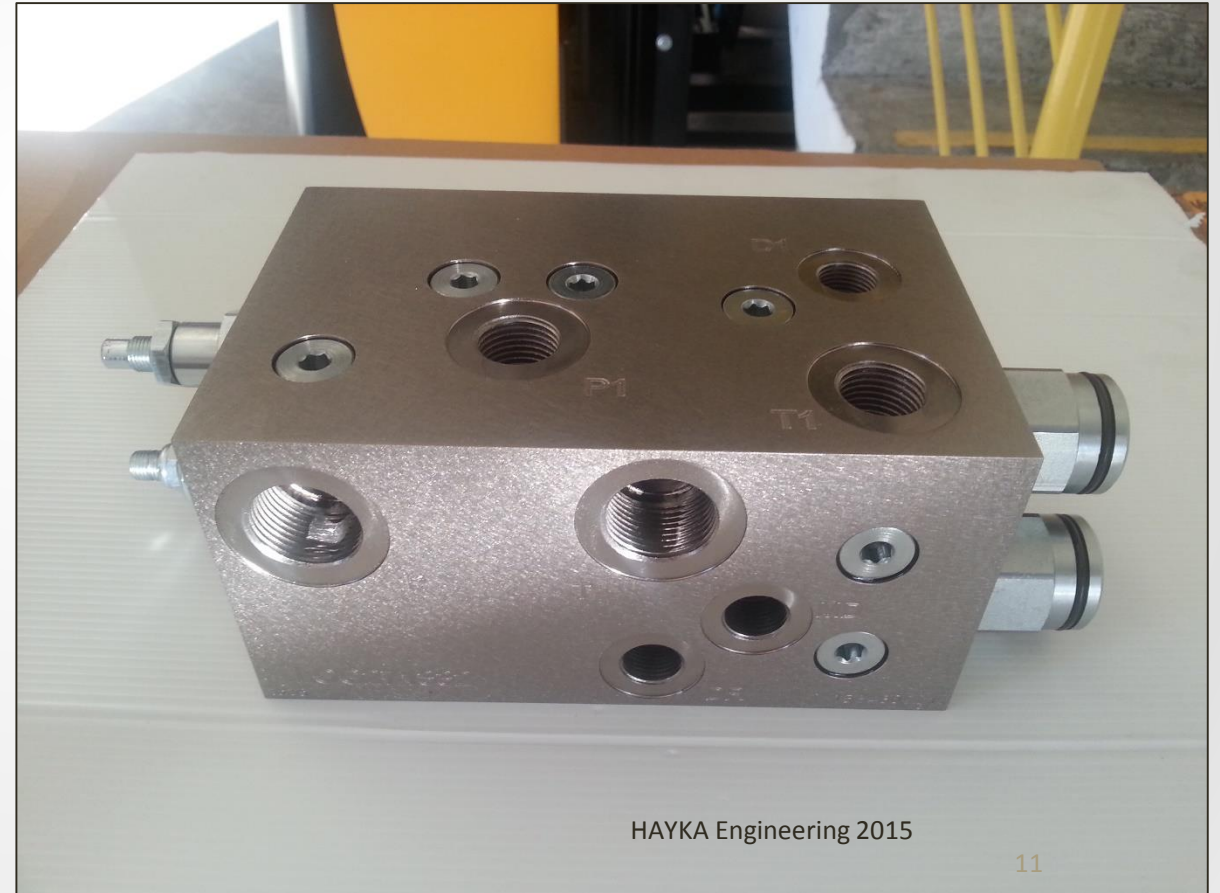
- In order to re-spool the cable it must be unloaded out of the throat of the S/car & laid out on the roadway so that cable can be re-spooled onto the realer. 2-3 men are required for this task, once again been exposed to unnecessary risk.
- It is then re-energized so that hydraulic power is available to reel the cable back on to the S/CAR realer.



“SOLUTION”

REELSAFE HYDRAULIC CABLE REEL CIRCUIT

- The Cable Reel Circuit is designed to remotely drive the Shuttle Car cable reeler via any machine with hydraulic supply.
- The circuit provides increased safety, productivity & reduces the chance of cable damage considerably.



REELSAFE CIRCUIT SCHEMATIC OVERVIEW

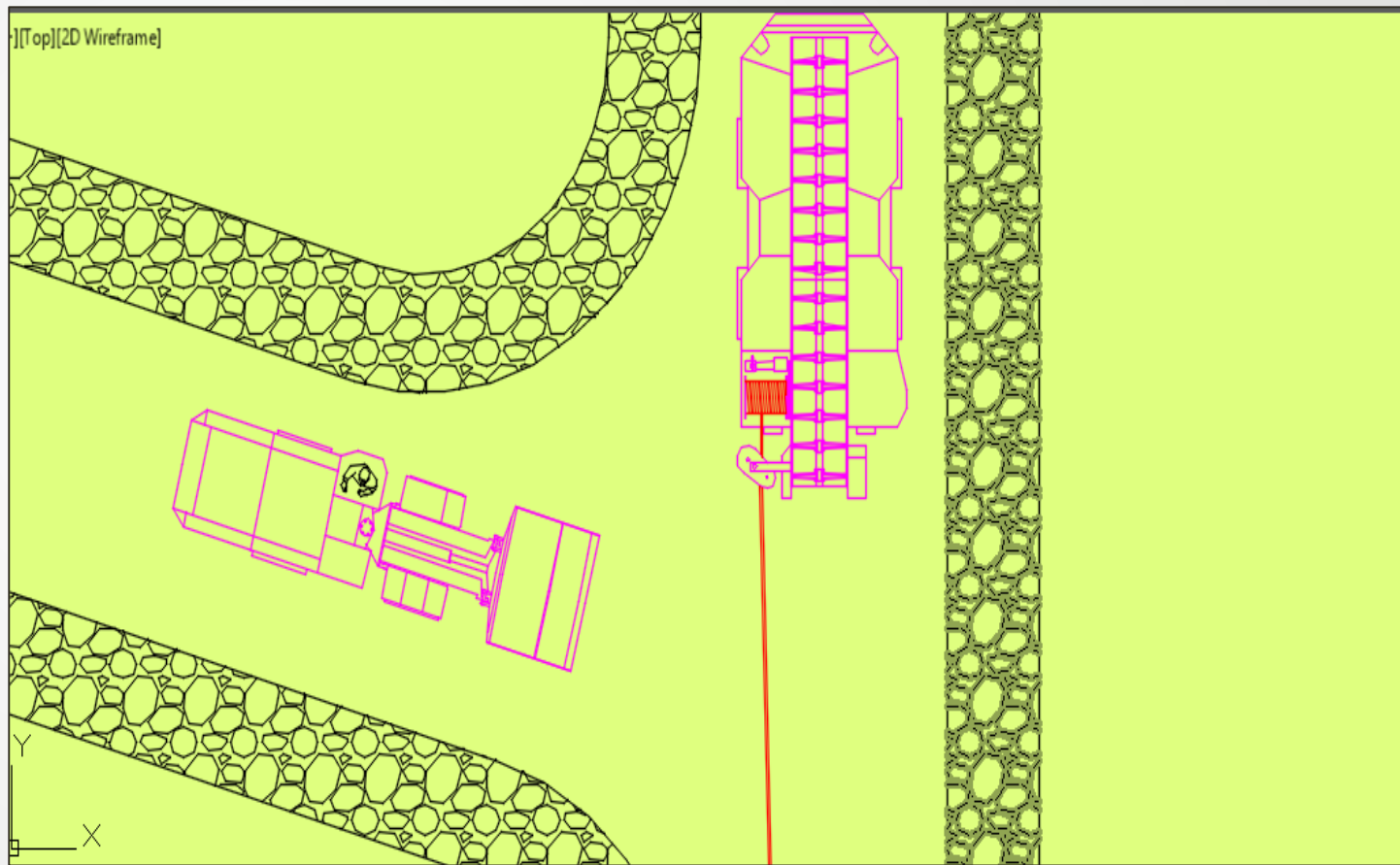


RETRO SCHEMATIC.pdf



MOBILE HYDRAULIC SUPPLY

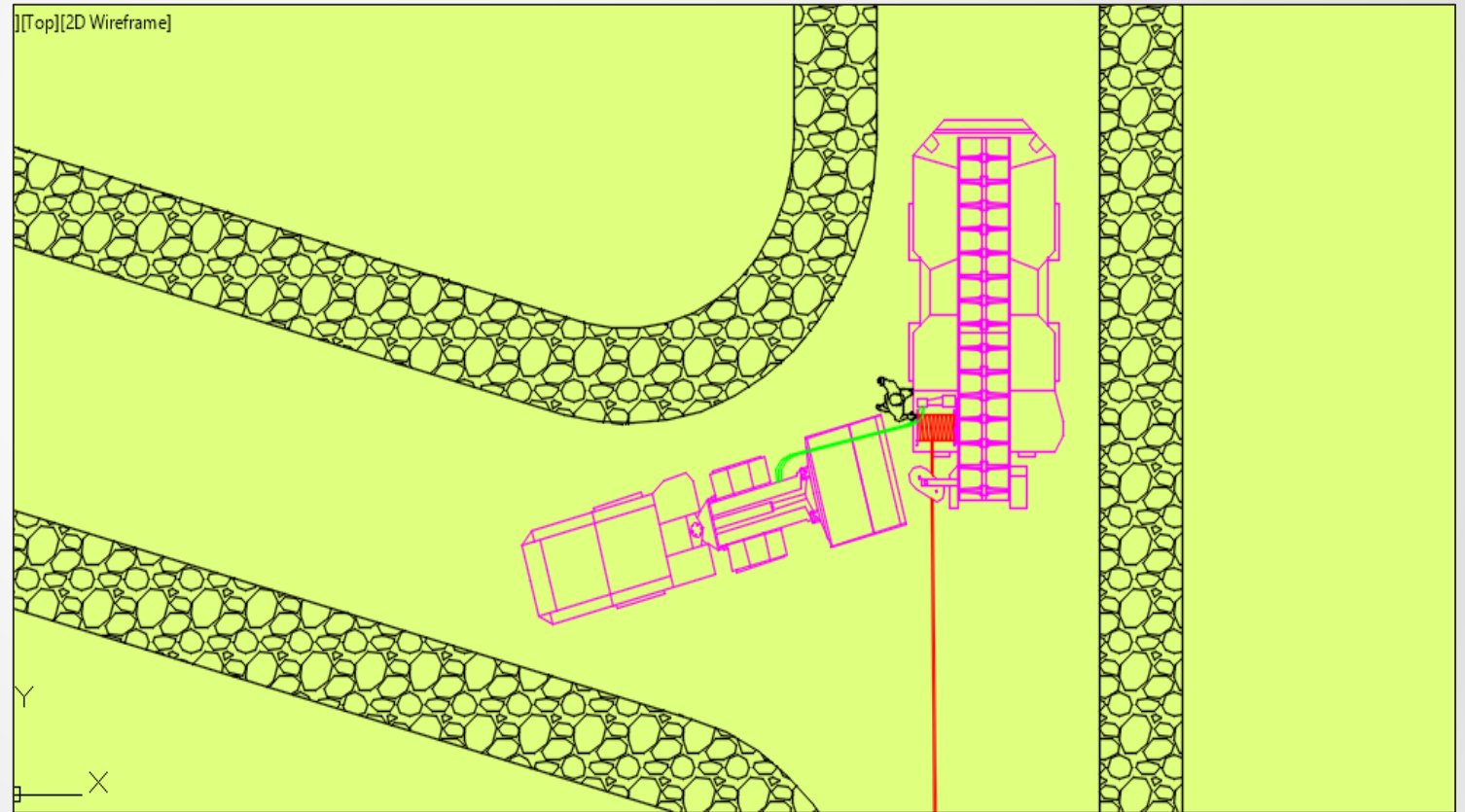
- The preferred machine for the supply of remote hydraulic power is the LHD MIS
- The MIS locking tongue circuit is the preferred of the three for it has the ability of variable flow control through the MIS Directional control valve.

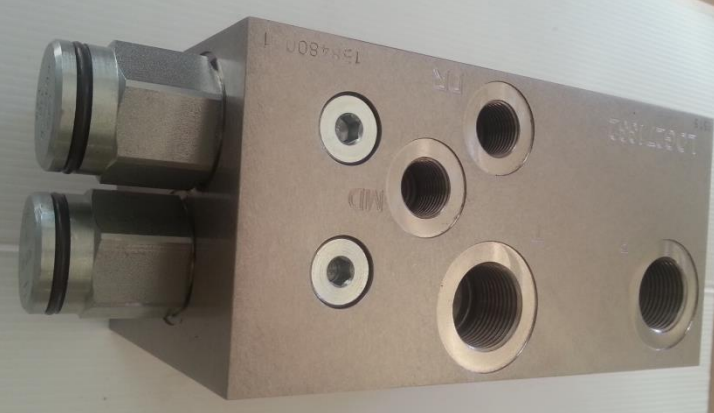




SETTING UP FOR REMOTE REELING

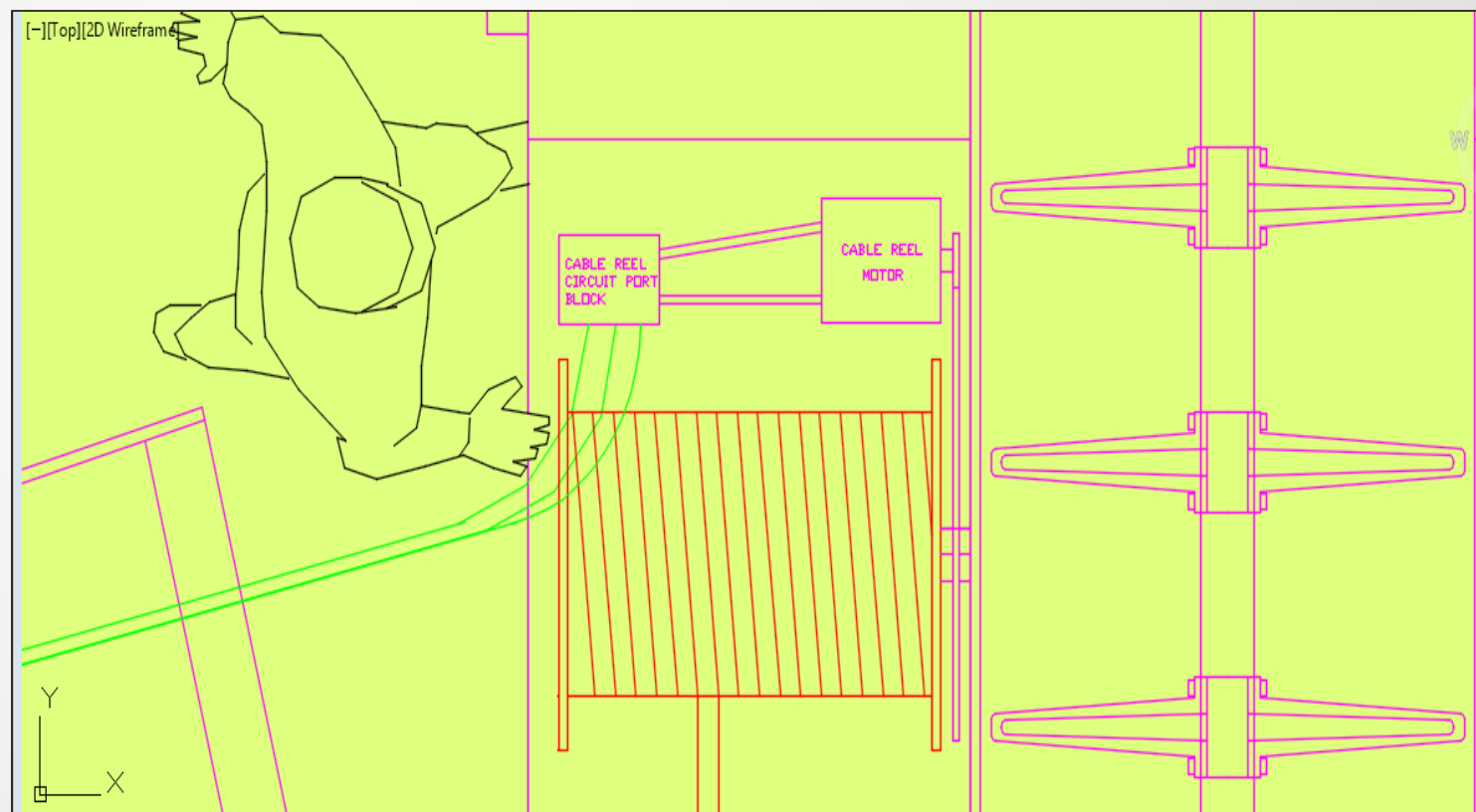
- The LHD is parked to the front end of the Shuttle car on the cable reel side at a safe distance for operator to access. Mine site No go zones are to be followed
- The operator will then set up the hydraulic jump hoses ready for connecting both machines.
- Hoses are roughly 5 mtrs in length





SETTING UP FOR REMOTE REELING

- With jump hoses in hand the operator then connects the LHD to the Cable reel circuit via the MIS locking tongue quick connects.
- Once attached, the circuit pressure senses from the LHD Hydraulics & automatically isolates Shuttle car hydraulics & introduces the LHD hydraulics ready for operation.



OPERATION FROM CABIN OF LHD

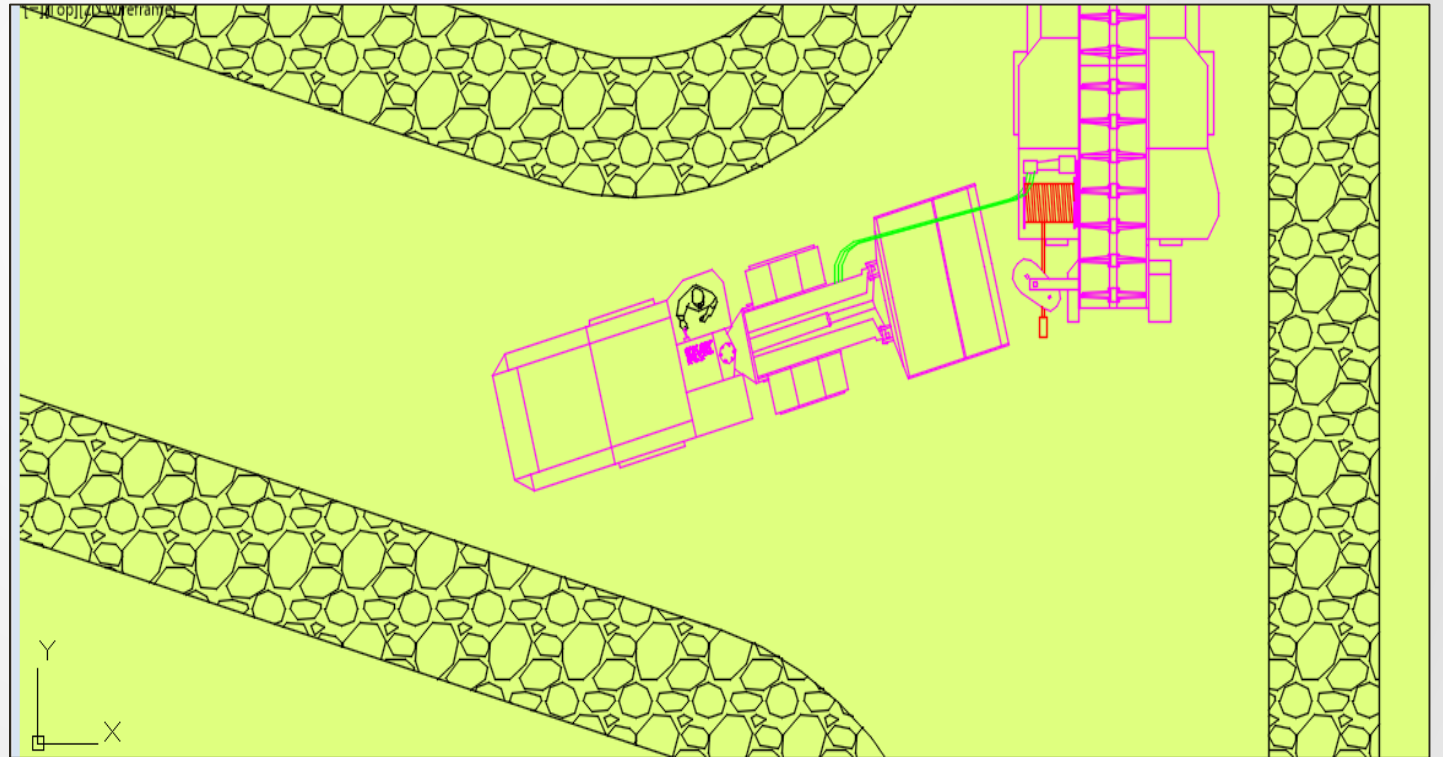


- Once both machines are connected the operator can operate the cable reel from the safety of the LHD cabin using the MIS control toggle, with the cable spooling onto the reeler with ease.
- A spotter is needed at all times to notify operator of any issues.



DISCONNECTING FROM THE SHUTTLE CAR

- Once cable is wound onto the reeler the hoses are disconnected from both machines. The Cable reel circuit then automatically changes back over to the Shuttle car hydraulics with the spring return cartridges returning to the closed position.
- The task has been performed by TWO men throughout the operation.
- The automated hydraulic change over is a feature to prevent there been human error. Therefore there is no need to rely on the operator to open & close hydraulic supply from either the LHD or Shuttle car.



END

Thank- You

