‘Test for Isolation’ (TFI) Box
New Hope Group – New Acland Coal

The Problem

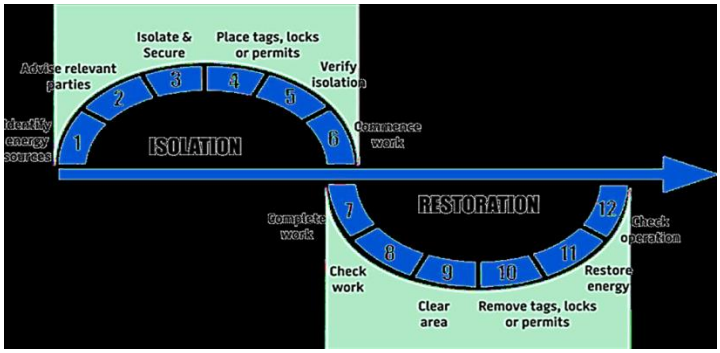
Queensland coal mines operate under the regulatory framework of the Queensland Coal Mining Safety and Health Act (1999) and Regulations (2001).
Section 78 of the Queensland Coal Mining Safety & Health Regulations (2001) prescribes the way in which coal mines must manage risk in relation to isolation (extract below)

78 Isolating and tagging procedures
(1) A coal mine must have a standard operating procedure for the following—
(a) controlling the risk of an unplanned release of energy from plant, including positively isolating the energy source;
(b) if an electrical or mechanical energy source is positively isolated—testing for zero potential;
(c) taking plant out of service;
(d) returning plant to service.

The New Hope Group operates a large mining fleet of heavy earthmoving equipment across its operating coal mines and rehabilitation sites. This equipment is isolated via a low voltage isolation switch isolating the earth (negative) side of the on-board electrical circuit when switched to the ‘open’ position. Positive isolation practices are applied prior to personnel accessing the 12’o-clock shadow of machines. This typically includes for the purposes of;

- Pre-start checks,
- Servicing/Refuelling,
- Maintenance activities,
- and various other tasks.

Current isolation practices are based on the 12 step isolation process (as per below) which includes verification of effective isolation. Typically, verification is achieved by attempting to ‘start’ the machine via the ignition switch which requires the operator to access the operator cabin via the respective access systems/points. It is assumed that by attempting to start the machine (and the machine not starting), that no electrical energy is present. This process presents an inherent level of risk due to the continued required access to the operator cabin to verify isolation (ergonomics) and the personnel behaviours required to achieve compliance due to the additional physical requirements of the task. This was most evident in a recent incident that occurred at the New Acland Coal mine where during the verification process of isolating a machine for a pre-start inspection, a Caterpillar 789C Off-Highway Truck engaged the engine when attempting to be started. Upon investigation, the main isolation switch was found to be sound (and functioning correctly), however an earth had been introduced to the circuit due to installation of a non-insulated washer on an ancillary system. No recent maintenance (i.e. preceding 7 days) had been conducted on the machine, prompting the question – ‘how frequently is the verification process being applied in the isolation process’?



Additionally, when utilising the ignition switch to verify an isolation, the person doing is required to have a good understanding of the functions of each machine and how to stop and manoeuvre it should it happen to start unexpectedly in the process.

The use of the ignition switch to verify isolation also presents issues to additional personnel required to access a machine that has already been isolated. While current process allows for verification to be achieved via communication, visual references of gauges etc, these types of checks do not allow for 'testing' of the isolation. Should a 'test' be applied, all personnel already working on the machine are removed from the machine and a test of the isolation is undertaken by turning the ignition switch. This introduces additional risk should the isolation be found not be effective in this process and the engine engages.

The Solution

New Acland Coal has developed a 'Test for Isolation' (TFI) Box that is designed to test the effectiveness of the isolation directly at the isolation point. This box is mounted at the isolation point, providing a single location for the isolation and verification of the machine electrical circuit. This also means that verification of isolation or 'Test for zero potential' can be achieved without having to access the cabin of the machine or attempting to engage the engine.

The design of the box is such that it tests the effectiveness of the isolation utilising the powered on-board systems to illuminate a LED light. Should the circuit not be effectively isolated, the light will fail to illuminate indicating that isolation has not been achieved. Additionally, the TFI box includes a 'test' switch to verify isolation via a change in state of the illuminated LED light.

The light to 'ON' design (when isolated) also provides certainty in the verification of effective isolation – removing the uncertainty of a non-functioning light and providing compliance with a 'test for zero potential' process.

The TFI box is designed to;

1. Ensure the LED changes state to illuminated when the isolator switch is open – Verifying effectiveness of the isolation
2. Ensure the LED changes state to illuminated when the isolator switch is open and the 'test' switch is utilised - providing verification of isolation.
3. Fail safe – i.e. should it fail, the light will fail to illuminate indicating that isolation has not been achieved.
4. Tamperproof
5. Replaceable – i.e. easily changed with another unit should a fault occur.

Fail Safe: The 'Test for Isolation' box has been tested and proven to be fail safe that is, should the internal circuitry (or light) fail or not function as designed, the box would indicate isolation as not being effective and fail to illuminate the indicator light. The inclusion of the 'test' function, provides additional redundancy should there be any concern on the correct function of the TFI box

Benefits / Effects

While the TFI box still requires a manual step in the verification of isolation process, the location, accessibility and reduced physical requirement of the task are designed to provide for a reduced risk profile via the following;

1. Less risk to personnel of injury by reducing the amount of times a person needs to access the cabins of various equipment (reduced frequency)
2. Providing a single location for the task of isolation and verification – improving the likelihood of compliance with site and industry standards
3. Reduced risk of the engine becoming engaged / moving parts in the verification process (reduced consequence)
4. Improved ability for each person to effectively verify effective isolation mid-task without introducing the possible risk/s of engine engagement in a verification process (reduced consequence)

Transferability

Not only is it a legislative requirement within the Queensland Mining industry to 'test for zero potential' at a positively isolated energy source, the step of verification is imperative to ensure that latent energy risks are removed in all isolation practices. The TFI box provides an opportunity to verify electrical isolation at the physical point of isolation, minimising potential risks associated with electrical systems that have not been effectively isolated.

Innovation

While there are currently indicator lights fitted to some isolators on newer earthmoving equipment, (as part of current Australian Standards), in many instances this is not 'standard' in machine design, nor do 'indicator light' provide the ability to physically 'test' or verify isolation has been achieved (as per legislative requirements). Existing systems do not provide for legislative compliance, or the level of integrity and/or redundancy that the TFI box design caters for due to its 'fail safe' design and the inclusion of the 'test' switch, fuse & documented install procedure, ensuring positive isolation can be tested effectively

Approximate Costs

The cost of the system is minimal compared to the controlled outcomes and risk mitigation. The below table details system costs for the transmitter and inclusion receiver on 14 x Caterpillar Off-Highway Trucks (this is a material cost and excludes internal labour costs for system installation);

Component	**Number of Units**	**Cost per unit**
TFI Box	51	$290
Harness and installation	51	$195
TOTAL	$24,735	$485