



MONTHLY ELECTRICAL INCIDENTS

ASP Manufacturing

June 2022



Date: 24/06/2022

Location: Slab Caster Water Treatment Plant

Reference: I2126437

An electrician tasked to investigate why a VVVF drive was not working has received an **Electric shock** to the left hand when removing the VVVF. The drive was found to be internally faulty and needed to be replaced. After completing isolations and Test Before You Touch on all conductors terminated to the drive to ensure all conductors were de-energised, the drive was removed. With right hand at the top of the drive and the left hand at the bottom the electrician's left hand has touched one of the motor cable conductors and felt the shock. The conductors were again checked with a multimeter in normal setting and low-impedance setting, and found to be de-energised. This plant has a history of induced volts being recorded on isolated conductors due to the long cable runs. As a result of not initially testing with a low-impedance meter the induced volts have discharged into the electrician's hand wearing cut resistant gloves.

In areas with suspected induced volts follow as per the Electrical Safety Manual section 1.4.3.2 "If induced voltage is confirmed greater than 25V ac apply earth bonding as close to the work area as practical using an approved method", a risk assessment should be conducted to confirm the most practical method.



The inside of the motor starter with the drive cover removed before the VVVF was removed



A close up of the wiring at the bottom of the drive where the electrician's left hand came in contact with the motor conductor

High voltage maintenance team completing routine maintenance have opened up the oil tank of an OCB to find the oil black in colour and very thick with floating particles. The moving and fixed contacts were found melted away and burnt. The 6.6kV 400amp OCB is used as part of a DOL starter circuit for a synchronous motor which has a full load current of 128amps. Due to reliability issues of closing this breaker it has been reported the OCB has failed to latch and retain on a number of occasions. Unfortunately as a result of this issue there has been many attempts to close this OCB each time the synchronous motor has been required to start. The number of attempts has far exceeded the recommended of 3 causing the contact damage and the oil to heat up.

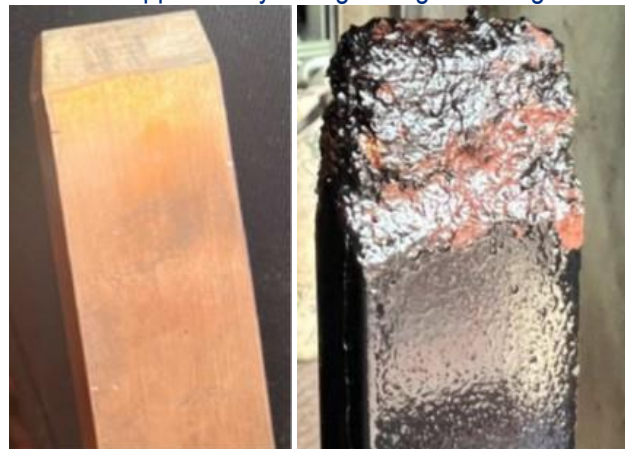
The starting of large motors DOL has to be managed correctly to ensure the starting equipment has adequate time to cool down before subsequent starting attempts are made. This is to ensure the starting equipment is safe and reliable to operate.



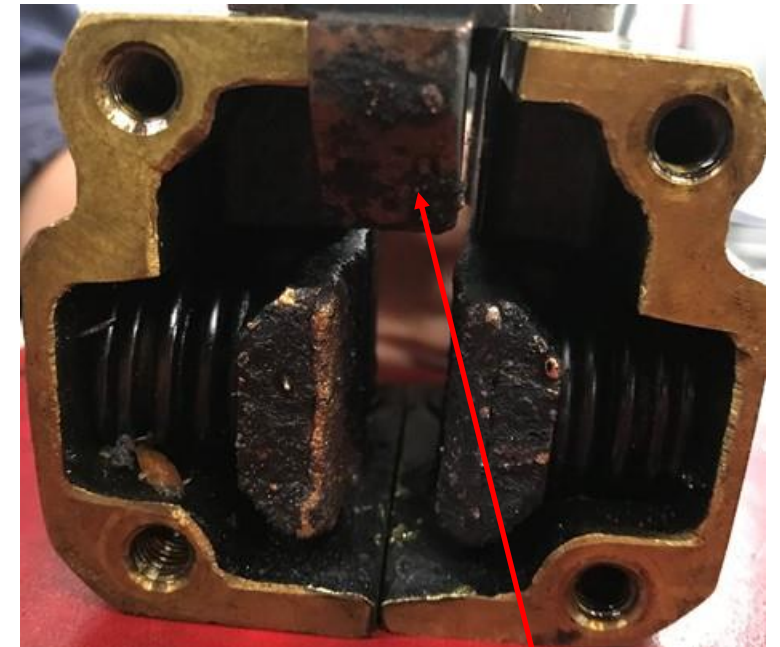
The front of the OCB breaker



A new and the used arcing (or sacrificial) contact which is used to suppress any arcing during switching



A new and used moving contact, note the amount of melted and missing copper which is not meant to happen to this contact



The main fixed contacts with the arcing contact mounted above.

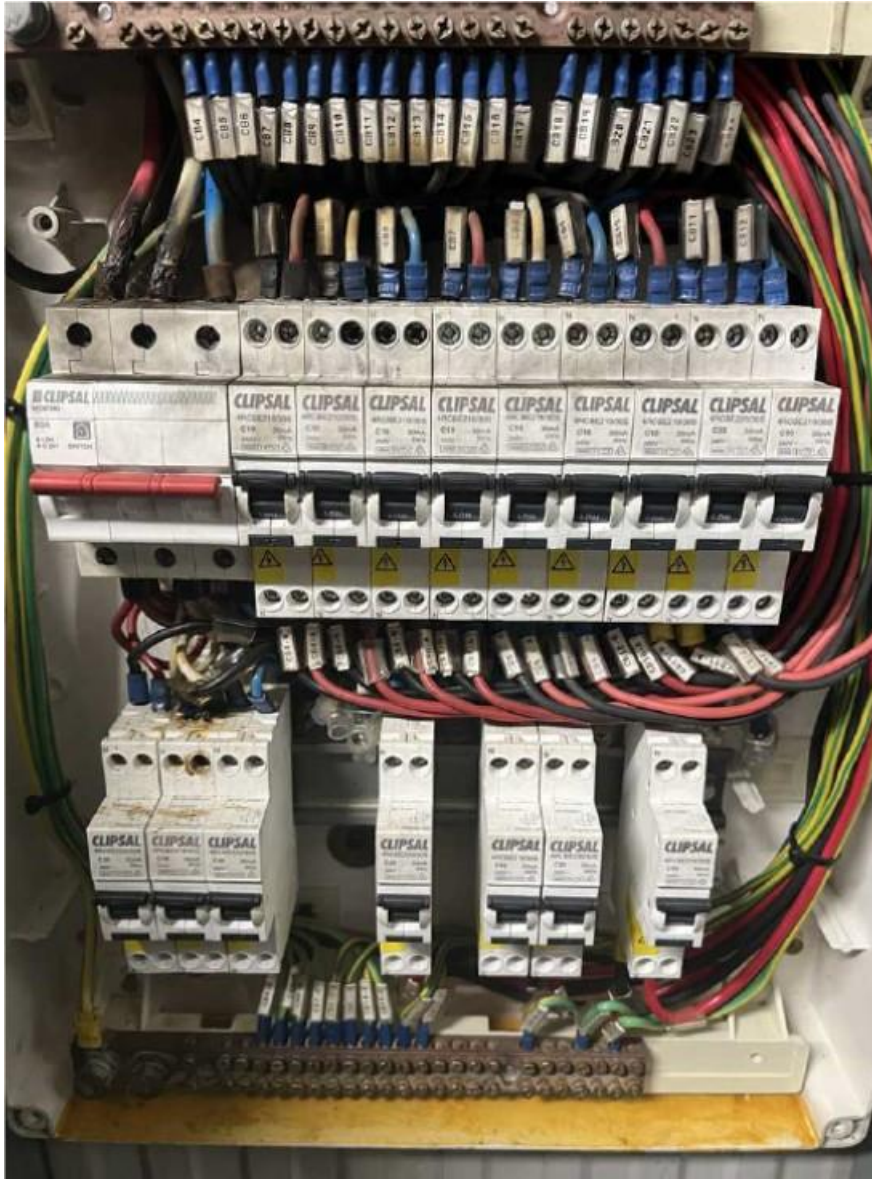
Note the fixed contacts are meant to be curved but due to the damage are flat and would be making very poor contact with the moving contact which moves up inside.

During scheduled maintenance of an MCC the main cabling inside a cell was found to be heat affected. One of the phase cores from the main fuses to the main contactor had all the single insulation, which has become brittle, falling off the conductor. The hot joint seems to have generated from one of the bolted connections of this cable. An internal investigation has found this 160amp removable starter had incorrectly been placed in the position for a 250amp starter, thus being under rated for the duty cycle of the 110kW motor. This MCC has inspections every 9 months on all its starters.

As per Electrical Safety Manual 1.4.22 all electrical installations shall be regularly inspected and maintained to the safety and satisfactory operation of the equipment. Equipment rating shall be taken into account when designing and installing to ensure the installation can withstand the duty cycle as per manufacturer's specifications.



The brittle and falling off insulation on the blue phase conductor of the MCC starter



An electrician investigating why the gallery switchroom had lost its lights has found a damaged distribution board. Inside the board the cabling to the main isolator was burnt due to a short circuit between phases. Water ingress from a roof mounted air conditioning unit seems to be the cause, where the water has run down the inside wall of the switchroom into the board due to top entry cable penetrations.

Ensure all electrical installations are suitable for the environment and have the appropriate IP rating. It is recommended that all cable entries are from the bottom. If the situation cannot avoid top cable entry all care should be taken to maintain the IP rating to eliminate water entry.

Inside the distribution board with the burnt main incomer cabling to the main isolator



The position of the distribution board on the switchroom wall

During a periodic inspection of terminations of the main connections from an ACB to the main pot inductors a hot joint was found. These inspection only occur every approximately 5 years. The 1600amp 415V ACB has 2 by 630mm² Al conductors run in parallel per leg. The hot joint had caused the bolted connection of one of these conductors to melt off the head of the bolt. This conductor has then become open circuited from the main busbar. Resulting in the other conductor carrying the full current of the inductor. This damage has been in this condition of a number of months.

As per Electrical Safety Manual 1.4.22 all electrical installations shall be regularly inspected and maintained to the safety and satisfactory operation of the equipment so that the installation does not become a significant potential cause of fire.



The bolted connection clearing open circuited from the busbar by the weigh of the cable and head of the bolt melting off



The back view of the busbar with melted and heat marks



The heat effected bolt with the heat end melted round to allow bolt to come away from the busbar