

LEADING THE ELECTRICITY DISTRIBUTION INDUSTRY



# DANGERS AND HAZARDS OF NOT WEARING PERSONAL PROTECTIVE EQUIPMENT

PRESENTED BY DJ JAMIESON

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# PURPOSE OF PAPER

- REPORT DETAILS OF INCIDENT THAT OCCURRED ON 11/03/2013 AND FINDINGS OF THE INVESTIGATION TEAM.
- At approximately 18:50 on the corner of Lea Road and Kent Street, Anderbolt, Boksburg, 4 staff members sustained serious burns whilst attempting to restore the electricity supply following a medium voltage outage in the Anderbolt area.

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# SEQUENCE OF EVENTS

- Electrician A and B plus special workman C and assistant D were called out to attend to an outage.
- A medium voltage circuit breaker tripped.
- They found the circuit to be without a fault “clean”
- They then racked the circuit breaker into position.
- Electrician A instructed the other personnel to exit the switching station.
- Electrician A then closed the circuit breaker.
- The circuit breaker failed catastrophically, causing a fire that injured Electrician A.

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- B,C and D ran back into the switching station and dragged Electrician A out of the building.
- C then phoned the Senior Operations Officer for assistance. The Senior Operations officer immediately made his way from home to the switching station and at the same time called for help from the emergency services.
- All injured personnel received emergency treatment at the scene and were transported to different hospitals.
- Electrician A suffered burns to approximately 50% of his body. He was airlifted and admitted to the Milpark Hospital for treatment and observation.

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- Electrician B suffered burns to his body. He was transported to the Glynwood Hospital and then transferred to the Milpark Hospital for treatment and observation.
- C and D suffered burns to their hands, arms and face. Both were transported to the Glynwood Hospital for treatment and observation.

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# OBSERVATIONS

The oil circuit breaker failed rupturing the oil tank. The moving contacts on the cable side of the circuit breaker were melted. The fixed contacts of the circuit breaker on the busbar side showed damage due to arcing. The rose joints on the busbar side of the circuit breaker were melted away. The busbar bushings on the panel were burnt extensively and the busbar chamber of the panel together with adjoining panels was filled with carbon and soot. A cable fault was located on the relevant circuit which when excavated was found to be burnt back from a transition joint by approximately 300mm.

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The tripping time of the feeder cable circuit breakers was set at 0.45 seconds and a circuit breaker operating time of .045 is assumed. Oil from the faulty circuit breaker was tested for insulation breakdown voltage and a value of 33kV was observed. Oil from an adjacent circuit breaker was tested and a value of 42kV was observed. The circuit breakers of sub 16 had a short circuit current rating of 150 MVA = 7.873kA. The calculated short circuit current at the time of the fault was 9.208kA (A 40MVA transformer with 22.8 % impedance at 11kV was supplying the switching station at the time of the incident)

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# *MOST LIKELY SCENARIO*

The medium voltage cable in question failed causing the protection system to operate and open the circuit breaker. On arrival the standby personnel racked out the circuit breaker and proceeded to test the circuit.

The test indicated no fault as they were testing between the earth and the cores of the cable. The fault most likely being a fault between cores or an open circuit fault of which the tester could not arc over the air gap. The personnel then racked the circuit breaker into position and the circuit breaker was closed.

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The resulting in-rush current caused the fault in the cable to draw a fault current that is calculated at 9200A. This fault current was enough to melt the moving contacts of the circuit breaker on the cable side and the resulting arc then flashed over onto the fixed contacts of the circuit breaker. The fixed contacts sustained damage and the rose joints between the circuit breaker and the busbar contacts melted. The intense heat and release of energy caused the busbar bushing to burn and the oil tank of the circuit breaker to rupture.

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The resulting fire destroyed the circuit breaker and caused damage to adjacent panels including the secondary wiring, the protection relays and ammeters. The fire also injured the personnel on site. The circuit breakers at the supply substation tripped isolating the supply to sub 16.

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# CONCLUSION OF INVESTIGATION

The short circuit current rating of the circuit breaker was exceeded sufficiently to cause a catastrophic failure of the circuit breaker.

The resultant fire caused enough damage to make the equipment in the switching station unsuitable for use.

The standby personnel omitted to utilise the personal protective equipment supplied to them for the functions that they were performing.

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# CONTRAVENTIONS

Part B of the EMM Energy Department's General Instructions, Operational Procedures and Policies, Section No 14, Substations Sub Section 14.4.5. And 14.4.6 states the following:-

*“14.4.5. No MV/HV/EHV switching, linking and earthing shall be carried out unless there is a minimum of two people present, an Authorised person and a responsible person.*

*“14.4.6. Before any switching, linking, earthing, etc. either MV/HV/EHV or LV is carried out the appropriate protective clothing and equipment **Must** be worn under all circumstances.*

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# DEPARTMENTAL RECOMMENDATIONS

**That** for the sole purpose of preventing incidents of this nature in the future the following be adhered to:

- In the induction course/training related to safety, first aid and the general instructions be included.
- Workshop the wearing of protective clothing and equipment.
- Amend the disciplinary procedure in order to empower the Chief/Acting Chief Area Engineers to suspend, without pay and without disciplinary enquiry for a period of one week, any person that does not comply with the wearing of protective clothing and equipment.
- refurbish the switching station with switchgear capable of withstanding at least 20kA fault current.

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# PERSONAL OBSERVATION

No mention of disciplinary action to being taken against the four persons injured for not wearing the personal protective equipment. This point was discussed at the Corporate Occupational Health and Safety Committee meeting.

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# CONCLUSION

Whenever possible all switching must be done remotely. Chief/ acting Chief Area Engineers must do more workshops with all staff on EMM Energy Department's General Instructions, Operational Procedures and Policies. All staff must do written tests following the workshops to ensure they understand the requirements of the Operational Procedures and policies with specific emphasis being put on safety and the wearing of safety clothing/ equipment. Any staff member found not wearing the required protective clothing/ equipment whilst performing any task must be sent home immediately without pay for that day or part thereof.

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