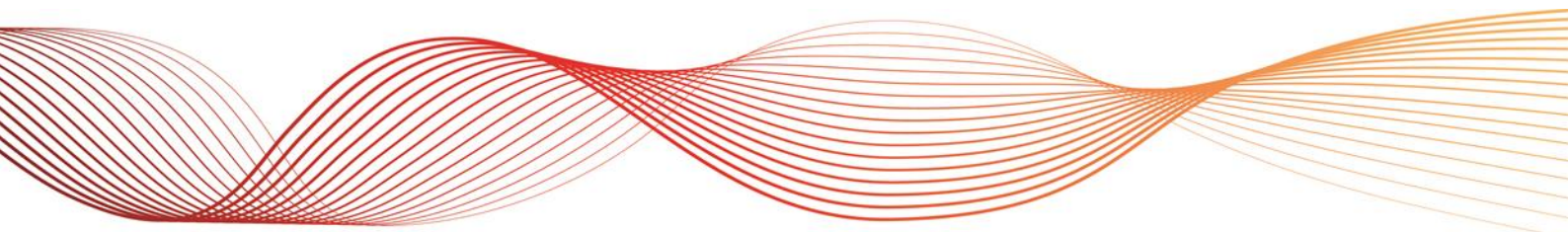




220 kV Busbar Trip at Brunswick Terminal Station on 6 June 2017

REVIEWABLE OPERATING INCIDENT REPORT UNDER THE NATIONAL ELECTRICITY RULES

Published: **3 August 2017**





INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	1142 hrs Tuesday 6 June 2017
Region of incident	Victoria
Affected regions	Victoria
Event type	Busbar trip (BB)
Generation Impact	No loss of generation
Customer Load Impact	No customer load was disconnected as a result of this incident.
Associated reports	Nil

IMPORTANT NOTICE

Purpose

AEMO has prepared this report in accordance with clause 4.8.15(c) of the National Electricity Rules, using information available as at the date of publication, unless otherwise specified.

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1. OVERVIEW

This report relates to a reviewable operating incident¹ that occurred on Tuesday 6 June 2017 at Brunswick Terminal Station (BTS) in Victoria. This incident involved the trip of the No.2 220kV busbar, a non-credible contingency.

There was no loss of customer load or any generation as a result of this incident.

As a reviewable operating incident, AEMO is required to assess power system security over the course of this incident, and assess the adequacy of the provision and response of facilities and services and the appropriateness of actions taken to restore or maintain power system security.²

AEMO has concluded that:

- The trip of the No. 2 220 kV busbar at BTS was caused by protection mal-operation.
- There was no high voltage fault on the busbar.
- The power system remained in a secure operating state during this incident.
- AEMO correctly reclassified the event as a credible contingency
- AusNet has instigated measures to prevent a re-occurrence of the protection issue.

This report is prepared in accordance with clause 4.8.15 of the National Electricity Rules (NER). It is based on information provided by AusNet Services (AusNet)³ and from AEMO's energy management systems.

Australian Eastern Standard Time (AEST) is used in this report.

2. THE INCIDENT

On Tuesday 6 June 2017 at 1142 hrs, the No2 220kV busbar at BTS tripped when the No2 220/22kV transformer group was re-energised after a planned outage. This was not an expected outcome for this type of switching. There was no high voltage fault on the busbar.

No generation or customer load was lost as a result of the incident.

The No. 2 busbar at BTS was returned to service at 1612 hrs on 6 June 2017.

The probability of a busbar fault is very low and so is an unexpected event known in power system security terms as a non-credible contingency event⁴.

3. PARTICIPANT INVESTIGATION

The following is based on information provided by AusNet.

This incident occurred when the No2 Transformer Group No2 busbar 220kV circuit breaker (CB) was closed to energise the transformer group after completion of a planned outage. Immediately after the CB was closed, all CBs connected to the No2 220kV busbar tripped.

Initial investigations by AusNet determined the busbar tripped when one of the two CB Fail functions associated with the No2 Transformer Group No2 busbar "Y" protection relay operated. The initiation of the CB Fail function was likely caused by highly unbalanced transformer inrush currents when the transformer group was energised. Prior to restoring the No2 busbar and the No2 Transformer Group the

¹ See NER clause 4.8.15

² See NER clause 4.8.15(b).

³ Information provided by AusNet Services has been provided on a without prejudice basis and nothing in this report is intended to constitute, or may be taken by any person as constituting, an admission of fault, liability, wrongdoing, negligence, bad faith or the like on behalf of AusNet Services (or its respective associated companies, businesses, partners, directors, officers or employees).

⁴ NER Clause 4.2.3 - Credible and non-credible contingency events; AEMO Power System Security Guidelines, Section 10 - Definition of a non-credible contingency events



suspect CB Fail function of the “Y” protection was isolated. All other main protection systems remained in service.

Further investigation by AusNet has found that two signals are required to be present to set the latch for the CB Fail function i.e.

1. Low set current check (for No2 Transformer Group No2 Bus CB).
2. CB Fail Initiate by Transformer protection.

In this incident, the first requirement was fulfilled when unbalanced three phase currents with significant direct current offset were recorded in the protection relays of the 220kV CB mainly as a result of magnetising inrush in the transformers. The current check in the protection relay is a combination of phase overcurrent and neutral overcurrent elements. The unbalanced current remained above the low set current check threshold for the entire period of CB Fail delay time. At the same time, the requirement of item two was fulfilled when a pulse of 2.5 milliseconds was present. This protection logic is intended to detect low level fault current in the event of a transformer low voltage fault and the 220kV CB has failed to operate.

This incident is similar to other incidents that have occurred on the AusNet 22kV distribution network. The protection relay involved is from the same manufacturer with the same type of digital inputs as those from previous incidents. To mitigate this issue, AusNet intend to:

- Install active burden modules (ABM) on each CB Fail initiation input of the “Y” protection relays on the 220kV transformer bus and tie CBs at BTS. These ABMs provide an alternative current path for stray discharges or transient currents.
- Increase the ‘de-bounce’ delay timer of all digital inputs to the “Y” protection relays from 2 ms to 10 ms, similar to the “X” protection relays.

Once these modifications have been completed, the part of the CB Fail protection that was isolated will be returned to service. This work is expected to be completed by December 2017.

4. POWER SYSTEM SECURITY

AEMO is responsible for power system security in the National Electricity Market (NEM). This means AEMO is required to operate the power system in a secure operating state to the extent practicable and to take all reasonable actions to return the power system to a secure state following a contingency event in accordance with the NER.⁵

The power system remained in a secure operating state during this incident. No action was required by AEMO.

4.1 Reclassification

Although the problem with the No2 220/22kV transformer protection had been identified and resolved prior to re-energising the No2 220kV busbar, AusNet were still investigating whether a similar protection issue existed with the No1 or No3 transformers. AEMO reclassified the loss of any of the 220/22kV transformers and the No2 220kV busbar at BTS as a single credible contingency from 1612 hrs on 6 June 2017.

Based on additional advice received from AusNet on 8 June 2017 that the suspect protection had been isolated on all the transformers at BTS, AEMO cancelled the reclassification at 1522 hrs on 8 June 2017.

⁵ Refer to AEMO's functions in section 49 of the National Electricity Law and the power system security principles in clause 4.2.6 of the NER



For this incident, the power system remained in a secure operating state over the course of the incident. AEMO correctly assessed the incident and reclassified it as a credible contingency event.

5. MARKET INFORMATION

AEMO is required by the NER and the operating procedures to inform the market about incidents as they progress. This section assesses how AEMO informed the market⁶ over the course of this incident.

For this incident, AEMO was required to inform the market on the following matters:

1. The occurrence of a non-credible contingency event - notify within two hours of the event.⁷
 - AEMO issued Market Notice 58699 at 1226 hrs – 44 minutes after the event.
2. Reclassification, details, and cancelation of a non-credible contingency – notify as soon as practical.⁸
 - AEMO issued Market Notice 58701 at 1626 hrs on 6 June 2017 advising participants of the reclassification.
 - AEMO issued Market Notice 58703 at 1522 hrs on 8 June 2017 advising participants the reclassification had been cancelled.

No other notifications were required.

6. CONCLUSIONS

AEMO has assessed this incident in accordance with clause 4.8.15 of the NER. In particular, AEMO has assessed the adequacy of the provision and response of facilities or services, and the appropriateness of actions taken to restore or maintain power system security.

AEMO has concluded that:

- The trip of the No. 2 220 kV busbar at BTS was caused by protection mal-operation.
- There was no high voltage fault on the busbar.
- The power system remained in a secure operating state during this incident.
- AEMO correctly reclassified the event as a credible contingency.
- AusNet have instigated measures to prevent a re-occurrence of the protection issue.

7. PENDING ACTIONS

AusNet is to complete modifications to the transformer “Y” protection relays for the 220kV Transformer Bus and Tie CBs at BTS and return the isolated part of the CB Fail protection to service by 31 December 2017.

⁶ AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see AEMO website

⁷ AEMO is required to notify the Market of a non-credible contingency event within two hours of the event - AEMO, *Power System Security Guidelines*, Section 10.3

⁸ AEMO is required to notify the market of a reclassification NER clause 4.2.3(g), details of the reclassification 4.2.3(c) and when AEMO cancels the reclassification 4.2.3(h)