

Power System Operating Incident Report – Trip of Murraylink and North West Bend-Monash-Berri 132 kV Transmission Line on 30 September 2013

PREPARED BY: AEMO Systems Capability

DATE: 3 December 2013

FINAL

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Incident Classifications

Time and date and of incident	1553 hrs Monday 30 September 2013
Region of incident	South Australia
Affected regions	South Australia
Event type	TT – Loss of multiple transmission elements
Primary cause	PTN & CTR Protection and Control
Impact	Nil
Associated reports	Nil

Abbreviations and Symbols

Abbreviation	Term
AEMO	Australian Energy Market Operator
CB	Circuit Breaker
ElectraNet	Transmission Network Service Provider in the South Australia Region
EMMS	Electricity Market Management System
EMS	Energy Management System
kV	Kilovolt
NER	National Electricity Rules
NWB	North West Bend (substation in South Australia)

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1 Introduction

This report reviews a power system operating incident that occurred on 30 September 2013 in the South Australian region. AEMO is required to review this incident as it is classified as a non-credible contingency that satisfies the requirements of a reviewable operating incident under the National Electricity Rules¹ (NER).

The purpose of this incident review is to assess power system security over the course of the incident. The NER requires AEMO to assess the adequacy of the provision and response of facilities and services and the appropriateness of actions taken to restore or maintain power system security².

This report is based upon information provided by ElectraNet. Data from AEMO's Energy Management System (EMS) and Electricity Market Management System (EMMS) has also been used in analysing the incident.

All references to time in this report are to National Electricity Market time (Australian Eastern Standard Time).

2 The Incident

On 30 September 2013, at 1553 hrs, the North West Bend (NWB) - Monash - Berri No.2 132 kV transmission line tripped then successfully auto-reclosed. Seven seconds later the Murraylink Sever Trip³ scheme operated causing Murraylink⁴ to trip.

No load or generation was lost as a result of this incident. Murraylink returned to service at 1725 hrs 30 September 2013.

3 Participant Investigation

ElectraNet investigated the incident and found that storm activity in the region was the likely cause of the NWB - Monash - Berri No 2 132 kV transmission line trip and auto-reclose.

For the trip of Murraylink, ElectraNet found that the operation of the Murraylink Sever Trip was caused by the coincident failure of two sets of communications – Set 1 and Set 2 – for the Murraylink Sever Trip scheme.

Following the trip of NWB - Monash – Berri No 2 132 kV transmission line, the Set 1 D25 communication relay at North West Bend Substation failed for 6 seconds and then returned to normal operation.

The Set 2 D25 relay at North West Bend Substation was found to have a faulty communications card which was failing intermittently. Problems with Set 2 were noticed during an inspection in October 2012. At that time the relay was deemed operational and a replacement was scheduled for late 2013.

The Set 1 communication failure coincided with a Set 2 communication failure resulting in a loss of communication⁵ for the Murraylink Sever Trip scheme. For such a communication failure the Murraylink Sever Trip scheme is designed to operate and thereby operated correctly.

¹ NER v57 Clause 4.8.15(a)(1)(i) and AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

² NER v57 Clause 4.8.15 (b)

³ Refer to Appendix A for a brief description of the Murraylink Sever Trip Scheme

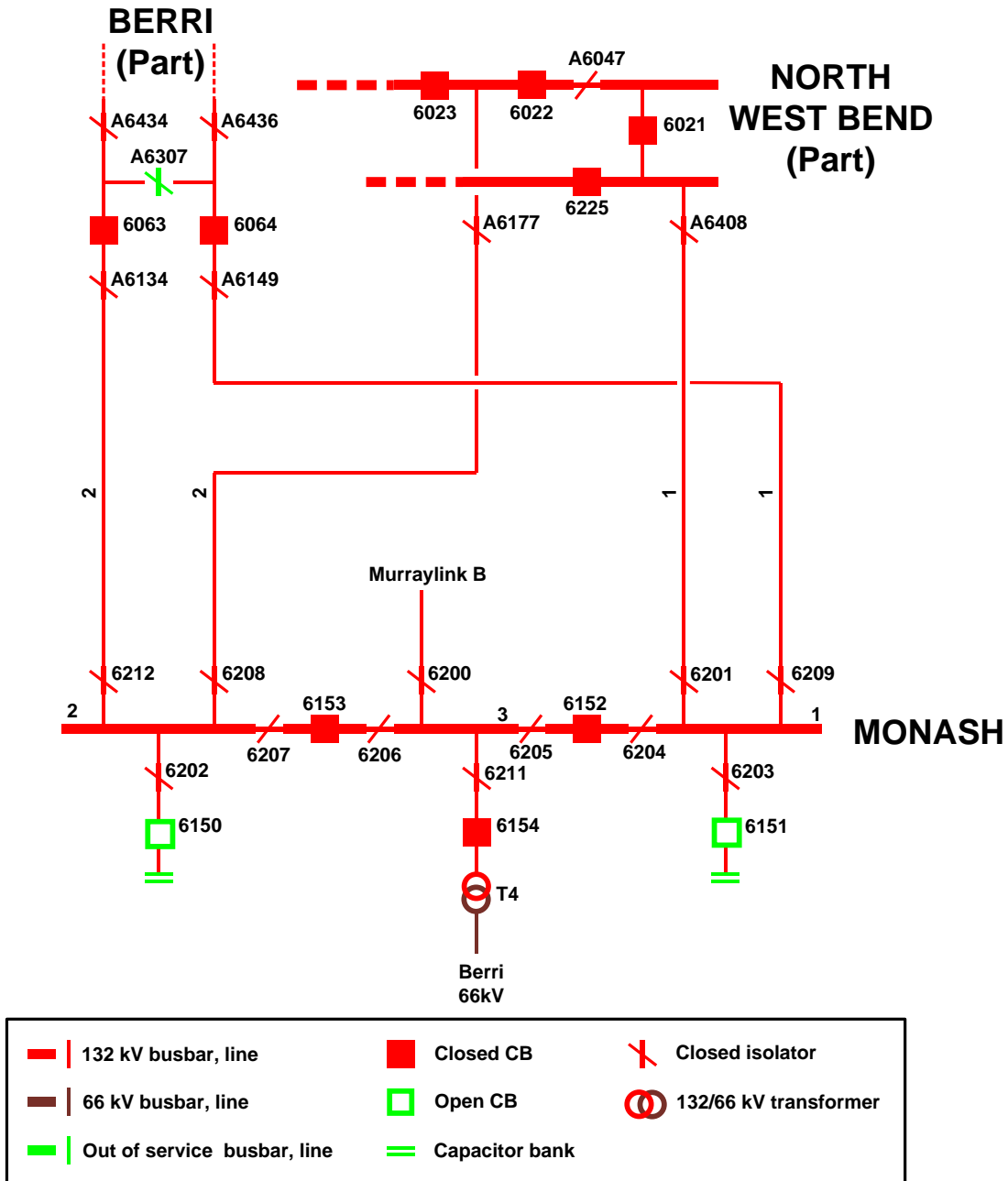
⁴ Murraylink is an interconnector between Red Cliffs substation in Victoria and Monash substation in South Australia. It is operated by Australia Pipeline Trust (APA). ElectraNet has set up communication links and installed Murraylink Sever Trip and Murraylink Run Back control schemes to protect ElectraNet assets.

⁵ ElectraNet is currently installing a new communication path (NWB-Monash) using Radio/Microwave technology - estimated completion June 2014. This will improve the communication reliability for Runback/Sever Trip scheme.

4 Power System Pre-Incident

The status of the power system prior to the incident is shown in Figure 1. For clarity only equipment relevant to this incident has been included in the diagram. The diagram shows all lines in service.

Figure 1 - Status of the power system prior to the incident



5 Incident Event Log

The sequence of events comprising the incident are itemised in Table 1. The incident spanned approximately one hour from the trip of the NWB - Monash - Berri No.2 132 kV transmission line to the power system being returned to the pre-incident state.

Table 1 – Event Log

Date and Time	Event
30 Sept 2013 15:52:42	NWB - Monash - Berri No.2 132 kV transmission line de-energised
30 Sept 2013 15:52:45	NWB - Monash - Berri No.2 132 kV transmission line re-energised
30 Sept 2013 15:52	Murraylink Sever Trip Scheme initiated
30 Sept 2013 16:09	Market Notice 43461 issued: <ul style="list-style-type: none"> constraint set I-ML_ZERO invoked
30 Sept 2013 17:01	Murraylink B Substation reenergised
30 Sept 2013 17:23	Murraylink returned to service
30 Sept 2013 17:35	Market Notice 43466 issued: <ul style="list-style-type: none"> constraint set I-ML_ZERO revoked
30 Sept 2013 17:51	Market Notice 43467 issued: <ul style="list-style-type: none"> a non-credible contingency event the cause of the non-credible contingency event is not known the non-credible contingency event is reclassified as a credible contingency
30 Sept 2013 18:42	Market Notice 43468 issued: <ul style="list-style-type: none"> the loss of both the NWWB-Monash-Berri No.2 132 kV line and Sever Trip of Murraylink should not have occurred, and the reclassification of those circuits to be a credible contingency event until further notice
29 Nov 2013 16:35	Market Notice 44051 issued: <ul style="list-style-type: none"> cancellation of the reclassification of NWWB-Monash-Berri No.2 132 kV line and Sever Trip of Murraylink

6 Power System post Incident

The status of the power system after the incident is shown in Figure 2. The diagram shows Murraylink out of service via open CBs 6153, 6152 and 6154. The NWB - Monash - Berri No.2 132 kV transmission line had tripped and auto-reclosed before the Murraylink Sever Trip operated.

7 Immediate Actions

AEMO invoked constraint set I-ML_ZERO approximately seven minutes after Murraylink tripped. This action ensured that the power system was in a secure operating state by dispatching the market in accordance with zero flow on Murraylink. This action was within the thirty minute period in which AEMO is required to return the power system to a secure state following a contingency event.⁶

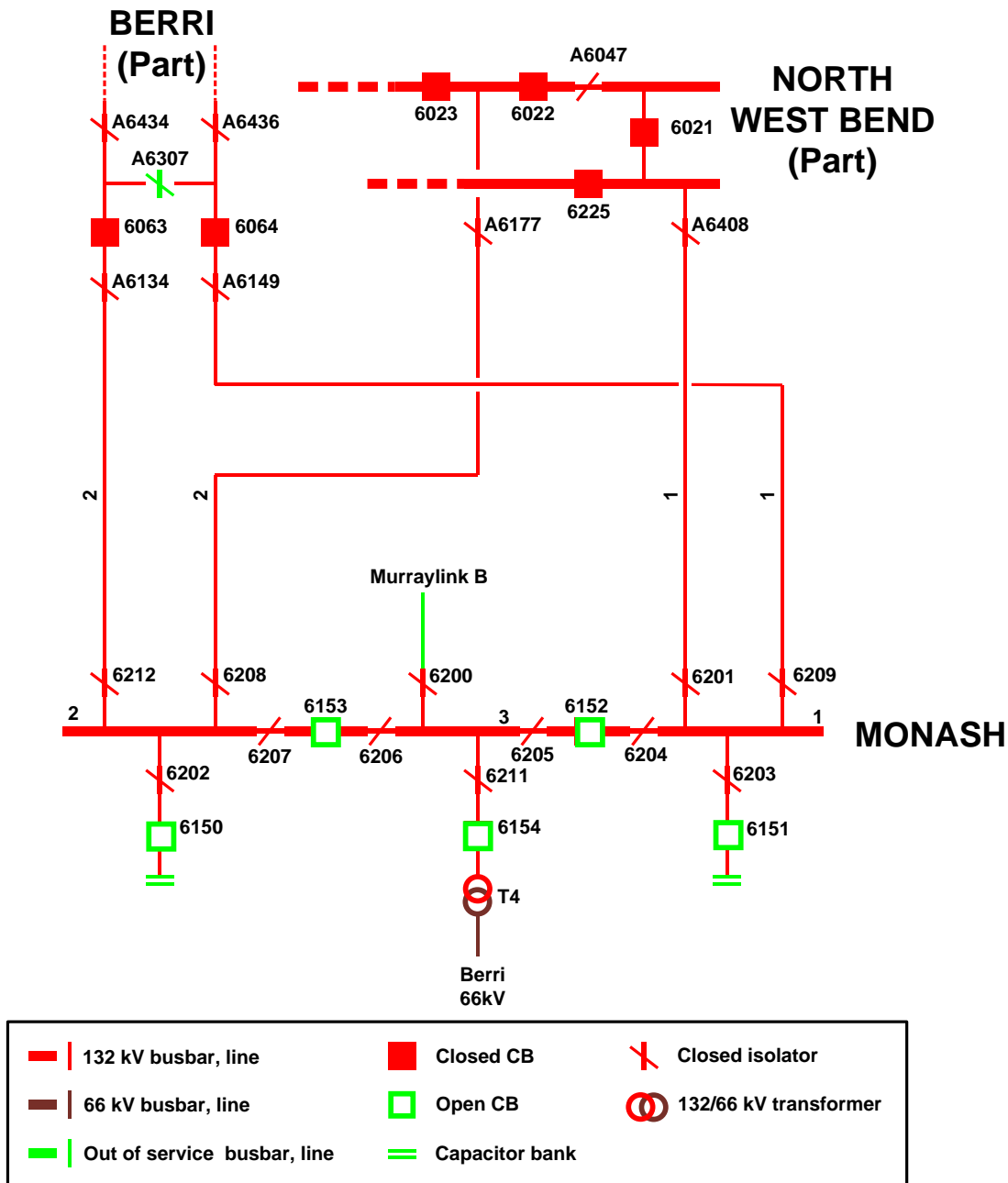
AEMO issued Market Notice 43467 at 1751 hrs to notify the market of the non-credible contingency event. AEMO issued Market Notice 43467 approximately 58 minutes after the trip of Murraylink. This notification was within the two hour period in which AEMO is required to notify the market of a non-credible contingency event⁷.

Murraylink was returned to service at 1723 hrs, and AEMO revoked Constraint Set I-ML_ZERO at 17:35 hrs.

⁶ *NER v 55* Clause 4.2.6 (b)

⁷ AEMO, *Power System Security Guidelines*, v54 Section 10.3

Figure 2 - Status of the power system immediately after the incident



8 Follow-up Actions

AEMO received the following advice from ElectraNet:

- Confirmation of a correct and successful auto-reclose of the NWB-Monash-Berri No.2 132 kV line.
- The possible cause of the Murraylink Sever Trip was a communication problem at NWB.
- ElectraNet was unsure if a simultaneous trip of North West Bend - Monash - Berri No.2 132 kV line and a Sever Trip of Murraylink may reoccur.

Upon receiving ElectraNet’s advice AEMO issued Market Notice 43468 at 1842 hrs. This notice declared that the simultaneous trip of North West Bend - Monash - Berri No.2 132 kV line and a Sever Trip of Murraylink was classified as credible contingency event.

AEMO is required to assess whether or not to reclassify a non credible contingency event as a credible contingency⁸ and to report how re-classification criteria were applied⁹. AEMO has to determine if the condition that caused the non-credible contingency event has been resolved. AEMO reclassified the simultaneous trip of the NWB - Monash - Berri No.2 132 kV line and a Sever Trip of Murraylink to be a credible contingency event because ElectraNet was uncertain of the cause of the event.

ElectraNet's subsequent investigation concluded that a coincident communication failure (Set 1 and Set 2) caused the Murraylink Sever Trip. The faulty communications card was subsequently replaced.

AEMO cancelled the reclassification of the North West Bend - Monash - Berri No.2 132 kV transmission line and a Sever Trip of Murraylink as a credible contingency on 29 November 2013. AEMO notified the market via Market Notice 44051. ElectraNet had notified AEMO that the faulty communications card had been replaced.

9 Power System Security

AEMO is responsible for power system security in the NEM and is required to operate the power system in a secure operating state¹⁰. AEMO must thereby ensure that the power system is maintained in, or returned to, a secure operating state following a contingency event.

AEMO invoked constraint set I-ML_ZERO to ensure that the power system was in a secure operating state. Constraint set I-ML_ZERO limits the flow Murraylink to zero in either direction and is required when Murraylink is out of service. This action ensured that in the event of a further credible contingency event the power system would be in at least a satisfactory operating state post-contingency. The constraint set remained correctly invoked while Murraylink was out of service.

10 Conclusions

The trip of the North West Bend - Monash - Berri No.2 132 kV transmission line on 30 September 2013 was most likely caused by lightning.

The subsequent Sever Trip of Murraylink was due to a coincident failure of communication equipment. The Murraylink Sever Trip scheme operated correctly for the communication failure.

AEMO took appropriate actions by invoking the required constraint to maintain power system security, and then reclassifying the trip of the North West Bend - Monash - Berri No.2 132 kV Line and Murraylink as a credible contingency.

Over the course of the incident AEMO and ElectraNet took appropriate action and power system security was maintained.

11 Recommendations

There are no recommendations arising from this incident.

⁸ NER v55 Clause 4.2.3A (c)

⁹ NER v55 Clause 4.8.15 (ca)

¹⁰ NER v55 Clause 4.2.4 (a)

12 Appendix A: Murraylink Sever Trip Scheme

Murraylink is a DC transmission line that connects Victoria to South Australia. Murraylink cannot supply an AC load (island) at one end of the DC line. The Murraylink Sever Trip Scheme is designed to trip Murraylink if the AC load at the SA end is islanded from the SA network – see Figure 3 below.

As the existing NWB, Berri, Monash and Murraylink B Substations are supplied through a radial system – see Figure 4 below, it is possible for the system to be “severed” from the South Australian grid. The automatic Sever Trip scheme is required to identify the “islanding” of the NWB, Berri, Monash and Murraylink B Substations from the South Australian Grid and trip the connecting circuit breakers CB 6152, CB 6153 and CB 6154 at Monash – see Figure 5 below. This prevents the possibility of part of the SA network being supplied by Murraylink without a frequency source.

Figure 3 – Murraylink Sever Trip Scheme Flow Chart

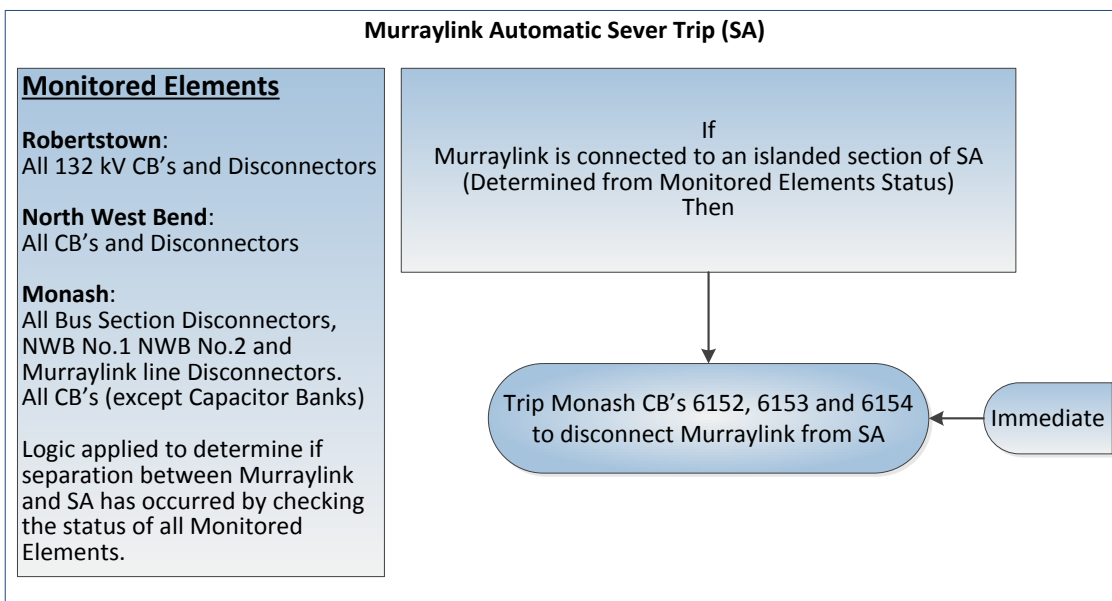


Figure 4 – Radial Network Connected to Murraylink

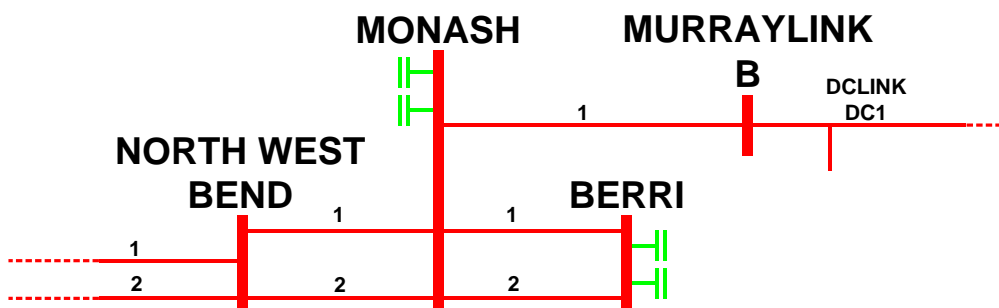
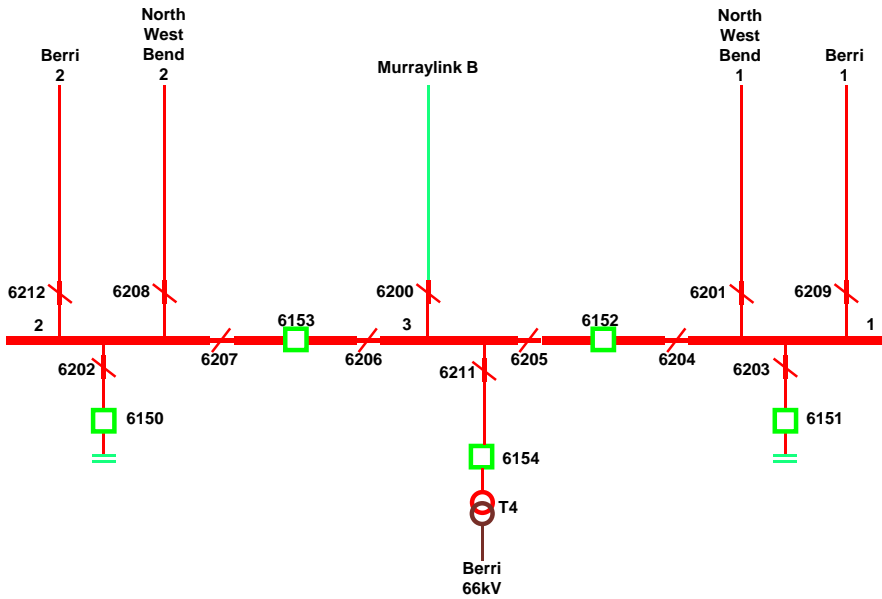


Figure 5 – Murraylink Sever Trip Scheme Operation

MONASH



132 kV busbar, line	Closed CB	Closed isolator
66 kV busbar, line	Open CB	132/66 kV transformer
Out of service busbar, line	Capacitor bank	