

# POWER SYSTEM OPERATING INCIDENT REPORT – TRIP OF SYDNEY WEST A1 AND A2 132 KV BUSBARS ON 18 DECEMBER 2012

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DATE:                 15 March 2013

FINAL

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## Abbreviations and Symbols

Abbreviation	Term
CB	Circuit Breaker
kV	Kilovolt
MW	Megawatt
NEM	National Electricity Market

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## Incident summary

<b>Date and time of incident</b>	18 December 2012 at 0515 hrs.
<b>Region of incident</b>	NSW
<b>Affected regions</b>	NSW
<b>Event type</b>	BB – Busbar trip
<b>Primary cause</b>	TE – Transmission equipment failure
<b>Impact</b>	Not Significant
<b>Associated reports</b>	N/A

## 1 Introduction

At 0515 hours on 18 December 2012, the A1 and A2 132 kV Busbars at Sydney West in New South Wales tripped due to explosive failure of the 132 kV A bus section circuit breaker (CB) 4102 ('**CB 4102**') at Sydney West Substation. Approximately 33 MW of customer load was interrupted as a result of this incident.

This report has been prepared under clause 4.8.15 (c) of the National Electricity Rules (NER) 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 security.

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

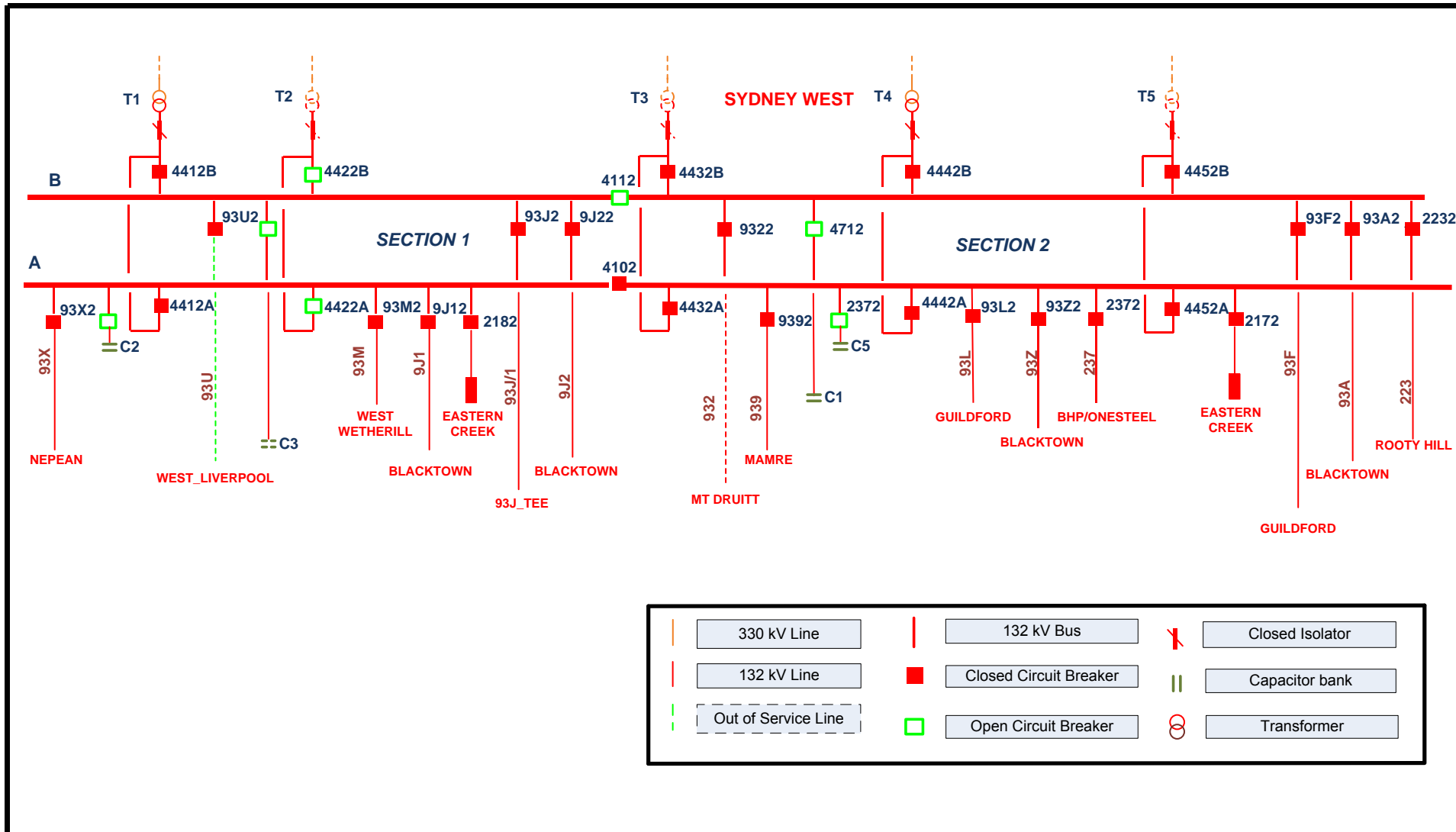
All references to time in this report are to National Electricity Market time (Australian Eastern Standard Time).

## 2 Pre-Contingent System Conditions

Prior to the incident, the T2 330/132 kV transformer at Sydney West was offloaded for a planned outage. And the four capacitor banks connected to the 132 kV busbars at Sydney West were also not in service.

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.

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



### 3 Summary of Events

The key events that took place during the incident are summarised in Table1 below.

Table 1: Summary of Events

Date/Time	Event
18/12/2012 05:13 hrs.	132 kV A bus section CB 4102 was closed.
18/12/2012 05:15 hrs.	<ul style="list-style-type: none"> <li>• 132 kV A bus section CB 4102 failed explosively.</li> <li>• 132 kV A1 and A2 buses tripped by opening the following circuit breakers:                             <ul style="list-style-type: none"> <li>○ T1 330/132 kV transformer CB 4412A</li> <li>○ T3 330/132 kV transformer CB 4432A</li> <li>○ T4 330/132 kV transformer CB 4442A</li> <li>○ T5 330/132 kV transformer CB 4452A</li> <li>○ T5 330/132 kV transformer CB 4452B</li> <li>○ 93X Nepean 132 kV feeder CB 93X2</li> <li>○ 93M Wetherill Park 132 kV feeder CB 93M2</li> <li>○ 9J1 Blacktown 132 kV feeder CB 9J12</li> <li>○ 93Z Blacktown 132 kV feeder CB 93Z2</li> <li>○ 939 Mamre 132 kV feeder CB 9392</li> <li>○ 93L Guildford 132 kV feeder CB 93L2</li> <li>○ 217 Eastern Creek 132 kV feeder CB 2172</li> <li>○ 218 Eastern Creek 132 kV feeder CB 2182</li> <li>○ 237 BHP/OneSteel 132 kV feeder CB 2372</li> </ul> </li> </ul>
18/12/2012 05:43 hrs.	<ul style="list-style-type: none"> <li>• 132 kV B bus section CB 4112 was closed connecting the B1 and B2 busbars together.</li> <li>• T2 330/132 kV transformer CB 4422A was closed placing the T2 transformer on load.</li> </ul>
18/12/2012 10:41 hrs.	132 kV A1 bus was returned to service.
18/12/2012 11:12 hrs.	AEMO issued Market Notice No. 40733.
18/12/2012 11:30 hrs.	132 kV A2 bus was returned to service.

TransGrid advised that the 132 kV A1 and A2 Busbars at Sydney West tripped on operation of busbar protection following the explosive failure of CB 4102.

The T5 330/132 kV transformer at Sydney West tripped on the operation of local backup protection opening the connected circuit breakers, CB 4452A and CB 4452B. Subsequently, the instantaneous overcurrent protection relay of the T5 330/132 kV transformer at Sydney West was found to be faulty; hence the local back-up protection system operated.

There was interruption to supply of approximately 33 MW of load supplied from Eastern Creek Zone Substation and OneSteel as a result of the tripping of the 132 kV A1 and A2 Busbars at Sydney West.

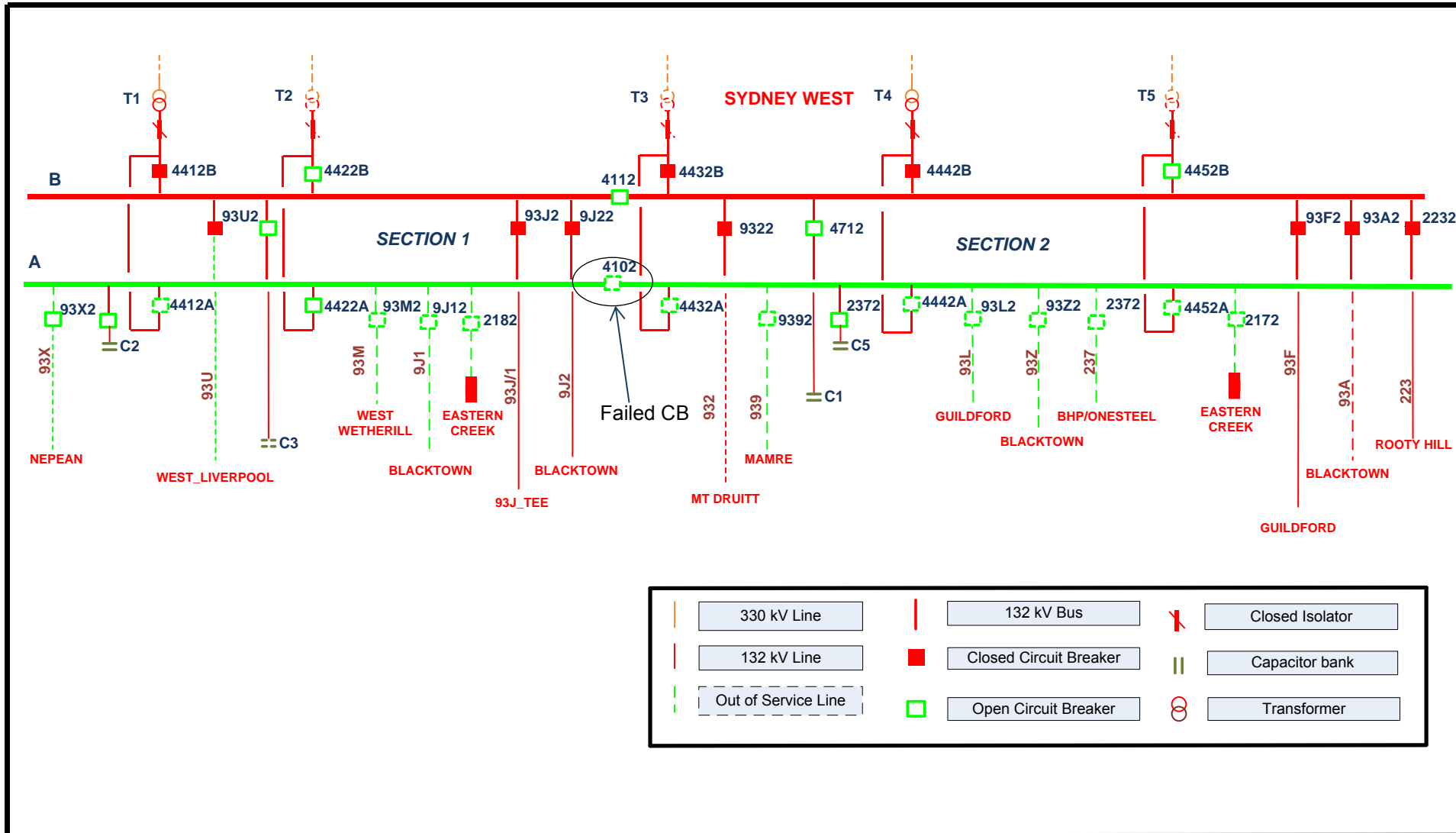
At 0541 hours on 18 December 2012, the supply to OneSteel was restored via a second feeder supplied from the Blacktown Substation which is normally open at OneSteel's end.

As the Eastern Creek Zone Substation is radially supplied from the Sydney West 132 kV busbars, the customer load supplied from this substation was interrupted for 5 hours and 29 minutes, and restored at 1043 hours on 18 December 2012.

The status of the power system immediately after the incident is shown in Figure 2.



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



## 4 Immediate Actions Taken

At 0543 hours on 18 December 2012, TransGrid performed the following immediate actions to manage the loadings of the transformers that connected to the 132 kV B busbars:

- closing the 132 kV B bus section CB 4112, connecting the B1 and B2 busbars; and
- closing the T2 330/132 kV transformer CB 4422B, placing the T2 transformer on load.

Based on information conveyed through TransGrid, AEMO determined that the event would not be reclassified as a credible contingency event because the possibility of reoccurrence was considered to be unlikely. AEMO did not issue a market notice to advise the market of the non-credible contingency within the required period of two hours as stated in section 11 of its Power System Security Guidelines.

## 5 Follow-up Actions

The follow-up actions taken by TransGrid in restoring the Sydney West 132 kV network after the incident are summarised in Table 2 below.

Table 2: Follow-up Actions Taken by TransGrid

Date/Time	Event
18/12/2012 10:41 hrs.	<ul style="list-style-type: none"> <li>• T1 330/132 kV transformer CB 4412A was closed, connecting the T1 transformer to the 132 kV A1 bus.</li> <li>• T2 330/132 kV transformer CB 4422A was closed, connecting the T2 transformer to the 132 kV A1 bus.</li> </ul>
18/12/2012 10:43 hrs.	<ul style="list-style-type: none"> <li>• CB 9J12 was closed, re-energising the 9J1 Blacktown 132 kV feeder.</li> <li>• CB 2182 was closed, re-energising the 218 Eastern Creek 132 kV feeder and restoring supply to Eastern Creek Zone Substation.</li> </ul>
18/12/2012 10:45 hrs.	<ul style="list-style-type: none"> <li>• CB 93X2 was closed, re-energising the 93X Nepean 132 kV feeder.</li> <li>• CB 93M2 was closed, re-energising the 93M Wetherill Park 132 kV feeder.</li> </ul> <p>Note: All feeders, which were connected to the 132 kV A1 bus prior to the incident, were returned to service at 10:45 hrs.</p>
18/12/2012 11:30 hrs.	<ul style="list-style-type: none"> <li>• T3 330/132 kV transformer CB 4432A was closed, connecting the T3 transformer to the 132 kV A2 bus.</li> <li>• T4 330/132 kV transformer CB 4442A was closed, connecting the T4 transformer to the 132 kV A2 bus.</li> </ul>
18/12/2012 11:32 hrs.	<ul style="list-style-type: none"> <li>• CB 93L2 was closed, re-energising the 93L Guildford 132 kV feeder.</li> <li>• CB 93Z2 was closed, re-energising the 93Z Blacktown 132 kV feeder.</li> </ul>
18/12/2012 11:33 hrs.	<ul style="list-style-type: none"> <li>• CB 2172 was closed, re-energising the 217 Eastern Creek 132 kV feeder.</li> <li>• CB 2372 was closed, re-energising the 237 BHP/OneSteel 132 kV feeder.</li> </ul>
18/12/2012 11:34 hrs.	<ul style="list-style-type: none"> <li>• CB 9392 was closed, re-energising the 939 Mamre 132 kV feeder.</li> </ul> <p>Note: All feeders, which were connected to the 132 kV A2 bus prior to the incident, were returned to service at 11:34 hrs.</p>
18/12/2012 15:08 hrs.	<p>Following the resolution of faulty instantaneous overcurrent relay issue TransGrid closed the T5 330/132 kV transformer CBs 4452A and 4452B, connecting the T5 transformer to the 132 kV A2 and B2 buses.</p>

At 1112 hours on 18 December 2012, AEMO issued Electricity Market Notice No. 40733 advising the occurrence of this non-credible contingency event. In the notice, AEMO also advised that the cause of this non-credible contingency has been identified, and this event would not be reclassified as credible contingency event as it was unlikely to reoccur. The market notice also advised the reduction in the demand in the New South Wales region of approximately 33 MW.

The requirement to issue a market notice within two hours of the occurrence of a non-credible contingency event on the transmission system has been reinforced with AEMO operations staff.

TransGrid performed further investigation into the failed CB 4102 and confirmed that the cause of the CB 4102 failure is similar to the cause of the CB 4112 failure that occurred at Sydney West on 28 March 2012<sup>1</sup>. The cause of the CB 4112 failure was identified to be the result of insufficient mechanical damping of the CB operating mechanism.

On 9 January 2013, TransGrid replaced the failed CB 4102 and returned it into service.

Since the occurrence of the CB failure on 28 March 2012, TransGrid initiated a program to overhaul the CB damper mechanisms on all CB's of the same type. Prior to this latest incident TransGrid inspected and tested the CB 4102, but had not yet overhauled the CB damper mechanism. TransGrid reviewed the response to the CB failure based on this latest incident and confirmed that the damper overhaul program is still the most appropriate long term strategy for the remaining CB's of the same type.

TransGrid advised that the damper overhaul program will be completed progressively upon the arrival of the ordered parts in the second quarter of year 2013. During the interim period, TransGrid will implement additional inspections and operating precautions on the CB's of the same type.

## **6 Power System Security Assessment**

The power system voltages and frequencies remained within the normal operating bands and the power system remained in a secure operating state throughout the incident.

The provision and response of facilities and services were adequate to maintain power system security.

## **7 Conclusions**

At 0515 hours on 18 December 2012, the A1 and A2 132 kV buses at Sydney West in New South Wales tripped due to explosive failure of the 132 kV A bus section circuit breaker (CB) 4102 at Sydney West.

Approximately 33 MW of customer load was interrupted as a result of this incident.

AEMO did not issue a market notice to advise the market of the non-credible contingency within the required period of two hours as stated in section 11 of its Power System Security Guidelines. The requirement to issue a market notice within two hours of the occurrence of a non-credible contingency event on the transmission system has been reinforced with AEMO operations staff.

AEMO correctly applied the criteria published in section 12 of its Power System Security Guidelines in assessing that the circumstances of this incident did not warrant reclassifying similar incidents as a credible contingency event.

## **8 Recommendations**

1. TransGrid will complete the CB damper overhaul program by 31 December 2013; however this completion date is subject to the availability of outages in some locations. TransGrid to advise AEMO if there is any change to the completion date.

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<sup>1</sup> Report available at [http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/~/\\_link.aspx?id=75AA54A0B125494D8AF27E61D3FCBDB7&z=z](http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/~/_link.aspx?id=75AA54A0B125494D8AF27E61D3FCBDB7&z=z).