# NEED/OPPORTUNITY STATEMENT (NOS)

Various Locations CT Renewal Program

NOS- 000000001338 revision 3.0

**Ellipse project no.:** P0007880
**TRIM file: [TRIM No]**

**Project reason:** Capability - Asset Replacement for end of life condition
**Project category:** Prescribed - Replacement

**Approvals**

| | | |
|---|---|---|
| Author | Robert Li | Substations Asset Strategist |
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| Approved | Lance Wee | Manager/Asset Strategy |
| Date submitted for approval | 2 December 2016 | |

**Change history**

| Revision | Date | Amendment |
|---|---|---|
| 0 | 29 March 2016 | Initial issue |
| 1 | 9 November 2016 | Update to format |
| 2 | 11 November 2016 | Updated CT list and associated risk value. |
| 3 | 25 November 2016 | Update to format |
| 4 | 2 December 2016 | Minor update to format |

# 1. Background

Current transformers (CTs) are essential for the control and protection of the high voltage network. They are used to indicate the main system current levels at a voltage that is useable by secondary systems equipment including control, protection and metering assets.

CTs can be categorised as follows:

- Post type SF6 gas insulated CTs.
- Oil filled 'live head' CTs where the primary conductor is a simple bar, with the secondary toroid installed around the bar at the level of the high voltage conductors. The insulation system is relatively simple.
- Oil filled 'hairpin' type CTs where the primary conductor is formed into a hairpin shape to allow it to be brought down into the tank located at the base of the unit. The insulation system is complex and is similar to an insulated bushing that has been bent.
- Toroidal CTs such as those installed on deadtank circuit breakers or GIS. These rely on the primary insulation provided by the equipment on which they are installed.

Gas CTs can be subject to gas leaks which can also lead to failure and a fault on the high voltage network. However, the population of these CTs is relatively young and the leaks encountered to date are being addressed as defects, and are not included in this Need Statement.

Failure of oil filled CTs will result in a fault on the high voltage network. An explosive failure may also result in the risk of injury to people, collateral damage and outages of nearby services. From the available failure records, hairpin CT types appear to have a higher risk of failure than 'live head' types due to the complexities in their design. They are also fitted with porcelain insulators which greatly increasing the risk of serious injury to personnel or damage to surrounding equipment.

Toroidal CTs have not created any issues and are not included in this Need Statement. The management of the risks associated with the failure of oil filled CTs are considered in this Need and Opportunity Statement.

# 2. Need/opportunity

Current transformers are in general, considered to be reliable, low maintenance items of plant. However, the failure mechanism will typically be catastrophic and in the case of older oil filled units, there is associated risk to personnel in the vicinity due to shards of porcelain ejected with great energy.

Oil filled CTs have been analysed to assess the remaining life and corresponding probability of failure. This assessment takes into account the age, DGA and known type issues. The probability of failure (based on the estimated remaining life and population wide probability modelling) along with an assessment of the consequences is used to derive the risk cost.

TransGrid's asset management strategy is broadly designed to monitor instrument transformer condition and retire units before the risk of explosive failure increases to an unacceptable level. Around 570 current transformers (just under 30% of the oil insulated CT population) are under consideration in this Need Statement. The total risk associated with this subset of the CT population is estimated at $4.8m per annum during 2019 to 2023 period. This risk value excludes those for which the associated CB also presents a risk and is therefore likely to result in a DTCB installation.

This Need Statement covers a program of current transformers that is required to be completed by 2023.

## 3. Related Needs/opportunities

The opportunities (additional benefits) associated with replacing the targeted current transformer and adjacent circuit breaker with dead tank type circuit breaker is detailed in the replacement strategy (D2015/07219).

## 4. Recommendation

It is recommended that options be considered to address the identified need.

## Attachment 1 – Risk costs summary

**Table 1 – Risk costs summary ($ thousand)**

| Asset Class | Total Risk Cost (RP2) | Need Date |
|---|---|---|
| Current Transformers | 4,767 | 2023 |

## Attachment 2 – CTs included in this Need Statement

**Table 2 – CTs included in this Need Statement**

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| COSBER2G | 94M MT PIPER TEE ILFORD 132KV FEEDER BAY | B01305/3 | 132 |
| NNSTOM1A | NO1 TRANSFORMER 330KV CB BAY | EC00003389 | 330 |
| NNSTOM1A | NO1 TRANSFORMER 330KV CB BAY | EC00003388 | 330 |
| NNSTOM1A | NO1 TRANSFORMER 330KV CB BAY | EC00003391 | 330 |
| SWSBKH3C1 | X2 BURONGA 220KV FEEDER BAY | EC00014781 | 220 |
| COSBER2C1 | NO3 TRANSFORMER 132KV CB BAY | B01306/1 | 132 |
| COSBER2C1 | NO3 TRANSFORMER 132KV CB BAY | B01306/2 | 132 |
| COSBER2C1 | NO3 TRANSFORMER 132KV CB BAY | B01306/3 | 132 |
| COSBER2J | 94B WELLINGTON 132KV FEEDER BAY | B01305/4 | 132 |
| COSBER2J | 94B WELLINGTON 132KV FEEDER BAY | B01305/5 | 132 |
| COSBER2J | 94B WELLINGTON 132KV FEEDER BAY | B01305/6 | 132 |
| COSBER2G | 94M MT PIPER TEE ILFORD 132KV FEEDER BAY | B01305/1 | 132 |
| COSBER2G | 94M MT PIPER TEE ILFORD 132KV FEEDER BAY | B01305/2 | 132 |
| SWSDN24L2 | 844 BARHAM 66KV FEEDER BAY | A07191/7 | 66 |
| SWSDN24L2 | 844 BARHAM 66KV FEEDER BAY | A07191/9 | 66 |
| SWSBKH3C1 | X2 BURONGA 220KV FEEDER BAY | EC00014778 | 220 |
| CMSSYW2T | 93A BLACKTOWN 132KV FEEDER BAY | A03055/5 | 132 |
| CMSSYW2T | 93A BLACKTOWN 132KV FEEDER BAY | A03055/4 | 132 |
| CMSSYW2T | 93A BLACKTOWN 132KV FEEDER BAY | A03055/6 | 132 |
| SWSBKH3C1 | X2 BURONGA 220KV FEEDER BAY | EC00014800 | 220 |
| SWSBRG3C1 | X2 BROKEN HILL 220KV FEEDER BAY | EC00014788 | 220 |
| SWSBRG3C1 | X2 BROKEN HILL 220KV FEEDER BAY | EC00014789 | 220 |
| SWSBRG3C1 | X2 BROKEN HILL 220KV FEEDER BAY | EC00014794 | 220 |
| NTSTA11G1 | 85 ARMIDALE 330KV FEEDER BAY | EC00003785 | 330 |
| NTSTA11G1 | 85 ARMIDALE 330KV FEEDER BAY | EC00003792 | 330 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| SWSBKH3E1 | X4 BROKEN HILL MINES 220KV FEEDER BAY | EC00014780 | 220 |
| SWSGRF2A1 | NO1 TRANSFORMER 132KV CB BAY | EC00013875 | 132 |
| SWSGRF2A1 | NO1 TRANSFORMER 132KV CB BAY | EC00013879 | 132 |
| SWSGRF2A1 | NO1 TRANSFORMER 132KV CB BAY | EC00013883 | 132 |
| SWSGRF2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00013869 | 132 |
| SWSGRF2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00013881 | 132 |
| SWSGRF2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00013884 | 132 |
| COSBER2B1 | NO2 TRANSFORMER 132KV CB BAY disconnected equipment | EC00010052 | 132 |
| SWSDN24K2 | 845 DENILIQUIN 66 - 66KV FEEDER BAY | A07191/5 | 66 |
| SWSDN24K2 | 845 DENILIQUIN 66 - 66KV FEEDER BAY | A07191/6 | 66 |
| SWSDN24K2 | 845 DENILIQUIN 66 - 66KV FEEDER BAY | A07191/4 | 66 |
| SWSDNT2F | 99K GRIFFITH 132KV FEEDER | EC00005854 | 132 |
| CMSSYW2Y | 939 MAMRE 132KV FEEDER BAY | EC00010149 | 132 |
| NTSGN22H | 9U3 BOGGABRI EAST - 132KV FEEDER | EC00022768 | 132 |
| NTSGN22H | 9U3 BOGGABRI EAST - 132KV FEEDER | EC00022769 | 132 |
| SWSDNT2G | NO1 CAPACITOR 132KV | EC00005851 | 132 |
| SWSDN24L2 | 844 BARHAM 66KV FEEDER BAY | EC00004131 | 66 |
| CMSSYW2B1 | NO2 TRANSFORMER 132KV A BUS CB BAY CB 4422A | EC00022757 | 132 |
| CMSSYW2B1 | NO2 TRANSFORMER 132KV A BUS CB BAY CB 4422A | EC00022755 | 132 |
| CMSSYW2K | 93M WEST WETHERILL PARK 132KV FEEDER BAY | A03057/4 | 132 |
| CMSSYW2K | 93M WEST WETHERILL PARK 132KV FEEDER BAY | A03057/5 | 132 |
| CMSSYW2K | 93M WEST WETHERILL PARK 132KV FEEDER BAY | A03057/6 | 132 |
| SWSBKH3E1 | X4 BROKEN HILL MINES 220KV FEEDER BAY | EC00014777 | 220 |
| SWSBKH3E1 | X4 BROKEN HILL MINES 220KV FEEDER BAY | EC00014779 | 220 |
| SWSDNT2F | 99K GRIFFITH 132KV FEEDER | EC00005857 | 132 |
| SWSDNT2F | 99K GRIFFITH 132KV FEEDER | EC00005858 | 132 |
| COSORG2N | No.1 TRANSFORMER 132kV TIE ORANGE NORTH FORMERLY 948 PANORAMA | EC00003210 | 132 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| SWSDNT2G | NO1 CAPACITOR 132KV | EC00005863 | 132 |
| CMSSE12HT | 925 WILLOUGHBY TEE 132KV FEEDER BAY | A02011/8 | 132 |
| CMSSE12HT | 925 WILLOUGHBY TEE 132KV FEEDER BAY | A02011/9 | 132 |
| CMSSE12HT | 925 WILLOUGHBY TEE 132KV FEEDER BAY | A02011/7 | 132 |
| CMSSYW2S | 93Z BLACKTOWN 132KV FEEDER BAY | A03055/7 | 132 |
| CMSSYW2S | 93Z BLACKTOWN 132KV FEEDER BAY | A03055/8 | 132 |
| CMSSYW2S | 93Z BLACKTOWN 132KV FEEDER BAY | A03058/9 | 132 |
| SYSMRU4H2 | 847 BOOROWA 66KV FEEDER BAY | ETA2144 | 66 |
| NTSNB22J | 9UH BOGGABRI NORTH - 132KV FEEDER | A08085/1 | 132 |
| NTSNB22J | 9UH BOGGABRI NORTH - 132KV FEEDER | A08085/2 | 132 |
| NTSNB22J | 9UH BOGGABRI NORTH - 132KV FEEDER | A08085/3 | 132 |
| SWSWG11L1 | 63 DARLINGTON POINT 330KV FEEDER BAY | EC00018705 | 330 |
| SWSWG11L1 | 63 DARLINGTON POINT 330KV FEEDER BAY | EC00018706 | 330 |
| SWSWG11L1 | 63 DARLINGTON POINT 330KV FEEDER BAY | EC00018704 | 330 |
| SWSDN22E | 99L COLEAMBALLY 132 - 132KV FEEDER | EC00013874 | 132 |
| SWSDN22E | 99L COLEAMBALLY 132 - 132KV FEEDER | EC00013927 | 132 |
| SWSDN22E | 99L COLEAMBALLY 132 - 132KV FEEDER | EC00013926 | 132 |
| SWSDNT1G1 | 63 WAGGA 330 - 330KV FEEDER BAY | EC00018699 | 330 |
| SWSDNT1G1 | 63 WAGGA 330 - 330KV FEEDER BAY | EC00018697 | 330 |
| SWSDNT1G1 | 63 WAGGA 330 - 330KV FEEDER BAY | EC00018702 | 330 |
| SWSWG11F1 | 62 JINDERA 330KV FEEDER BAY | A07107/3 | 330 |
| COSORG2N | No.1 TRANSFORMER 132kV TIE ORANGE NORTH FORMERLY 948 PANORAMA | EC00002979 | 132 |
| CMSSE12MU | NO8 TRANSFORMER 132KV CB BAY CB 4482 | A02014/6 | 132 |
| CMSSE12MU | NO8 TRANSFORMER 132KV CB BAY CB 4482 | A02014/4 | 132 |
| CMSSE12MU | NO8 TRANSFORMER 132KV CB BAY CB 4482 | A02014/5 | 132 |
| NTSGN22B1 | NO2 TRANSFORMER 132KV CB BAY | EC00010063 | 132 |
| NTSGN22H | 9U3 BOGGABRI EAST - 132KV FEEDER | EC00010040 | 132 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| SWSDNT2G | NO1 CAPACITOR 132KV | EC00002644 | 132 |
| CMSSYW2Y | 939 MAMRE 132KV FEEDER BAY | EC00010150 | 132 |
| CMSSYW2Y | 939 MAMRE 132KV FEEDER BAY | EC00010147 | 132 |
| CMSSYW2N | A1-2 132KV BUS SECTION CB 4102 | EC00010130 | 132 |
| SWSWG11F1 | 62 JINDERA 330KV FEEDER BAY | A07107/2 | 330 |
| SWSWG11F1 | 62 JINDERA 330KV FEEDER BAY | A07107/1 | 330 |
| NTSNB24BB4 | NO4 66KV BUS SECTION | A08082/8 | 66 |
| CMSSYW2B1 | NO2 TRANSFORMER 132KV A BUS CB BAY CB 4422A | EC00022756 | 132 |
| CMSSYW2J | 93J GRANVILLE TEE 132KV FEEDER BAY | A03054/2 | 132 |
| CMSSYW2J | 93J GRANVILLE TEE 132KV FEEDER BAY | A03056/7 | 132 |
| CMSSYW2J | 93J GRANVILLE TEE 132KV FEEDER BAY | A03056/9 | 132 |
| NTSAR11A1 | NO6 TRANSFORMER 330KV CB BAY | BESS32/3 | 330 |
| NTSAR11A1 | NO6 TRANSFORMER 330KV CB BAY | EC00008759 | 330 |
| NTSAR11A1 | NO6 TRANSFORMER 330KV CB BAY | BESS32/2 | 330 |
| CMSSE12KR | 9E2 KURINGAI 132KV FEEDER | A02011/1 | 132 |
| CMSSE12KR | 9E2 KURINGAI 132KV FEEDER | A02011/2 | 132 |
| CMSSE12KR | 9E2 KURINGAI 132KV FEEDER | A02011/3 | 132 |
| NTSAR11BB4 | NO4 330KV BUS SECTION | EC00008760 | 330 |
| NTSAR11BB4 | NO4 330KV BUS SECTION | BESS34/2 | 330 |
| NTSAR11BB4 | NO4 330KV BUS SECTION | EC00014214 | 330 |
| NNSER06B | NO2 33KV REACTOR | EC00014817 | 66 |
| CMSSYN1C1 | NO3 TRANSFORMER 330KV CB BAY CB 5432 | H71406/1 | 330 |
| CMSSYW1J | A1-2 330KV BUS SECTION CB 5102 | EC00003891 | 330 |
| CMSSYW1J | A1-2 330KV BUS SECTION CB 5102 | EC00003895 | 330 |
| CMSSYW1J | A1-2 330KV BUS SECTION CB 5102 | EC00003899 | 330 |
| SWSWG11E1 | 051 LOWER TUMUT 330KV FEEDER BAY | BESS40/3 | 330 |
| SWSWG11E1 | 051 LOWER TUMUT 330KV FEEDER BAY | BESS40/2 | 330 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| SWSWG12H2 | 9R5 WAGGA NORTH 132KV FEEDER BAY | A07108/7 | 132 |
| SWSWG12H2 | 9R5 WAGGA NORTH 132KV FEEDER BAY | A07108/8 | 132 |
| SWSWG12H2 | 9R5 WAGGA NORTH 132KV FEEDER BAY | A07108/9 | 132 |
| NNSER06B | NO2 33KV REACTOR | EC00014818 | 66 |
| CMSSYN1C1 | NO3 TRANSFORMER 330KV CB BAY CB 5432 | H71406/2 | 330 |
| CMSSYN1C1 | NO3 TRANSFORMER 330KV CB BAY CB 5432 | H71406/3 | 330 |
| CMSSE12G | A1-A2 132KV BUS SECTION CB 4102 | A02006/7 | 132 |
| CMSSE12G | A1-A2 132KV BUS SECTION CB 4102 | A02006/9 | 132 |
| CMSSE12G | A1-A2 132KV BUS SECTION CB 4102 | A02006/8 | 132 |
| CMSSYW2N | A1-2 132KV BUS SECTION CB 4102 | EC00010136 | 132 |
| CMSSYS1H1 | 11 DAPTO 330KV FEEDER BAY | BESS61/3 | 330 |
| NNSMRK1AC | 83 LIDDELL 330KV A CB BAY | EC00005384 | 330 |
| NNSMRK1AC | 83 LIDDELL 330KV A CB BAY | EC00005385 | 330 |
| NNSMRK1AC | 83 LIDDELL 330KV A CB BAY | EC00005386 | 330 |
| SWSWG11E1 | 051 LOWER TUMUT 330KV FEEDER BAY | BESS40/1 | 330 |
| NNSNEW1M1 | 95 TOMAGO 330 SS - 330KV FEEDER BAY | A09335/6 | 330 |
| CMSSE12MS | 959 SYDNEY NORTH 132KV FEEDER BAY | A02013/4 | 132 |
| CMSSE12MS | 959 SYDNEY NORTH 132KV FEEDER BAY | A02013/6 | 132 |
| CMSSE12MS | 959 SYDNEY NORTH 132KV FEEDER BAY | A02013/5 | 132 |
| SWSDNT3E2 | X5/1 BALRANALD 220KV FEEDER BAY | EC00014782 | 220 |
| SWSDNT3E2 | X5/1 BALRANALD 220KV FEEDER BAY | EC00014787 | 220 |
| CMSSE12MR | 9M3 WARRINGAH 132KV FEEDER BAY | A02010/6 | 132 |
| CMSSE12MR | 9M3 WARRINGAH 132KV FEEDER BAY | A02010/5 | 132 |
| CMSSE12ES | 9M2 WARRINGAH 132KV FEEDER BAY | A02012/4 | 132 |
| CMSSE12ES | 9M2 WARRINGAH 132KV FEEDER BAY | A02012/5 | 132 |
| CMSSE12ES | 9M2 WARRINGAH 132KV FEEDER BAY | A02012/6 | 132 |
| NNSTGH1AC | 21 SYDNEY NORTH 330KV A CB BAY | EC00003903 | 330 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| NNSTGH1AC | 21 SYDNEY NORTH 330KV A CB BAY | EC00003905 | 330 |
| NNSTGH1AC | 21 SYDNEY NORTH 330KV A CB BAY | EC00003904 | 330 |
| SWSLT11G1 | L1 Tumut 3 330kV Feeder Bay (Units 1-2) | ETA6344 | 330 |
| NTSNB24Z | NO3 66KV CAPACITOR | EC00008287 | 66 |
| NTSNB24Z | NO3 66KV CAPACITOR | EC00008288 | 66 |
| NTSNB24Z | NO3 66KV CAPACITOR | EC00008289 | 66 |
| SWSJDA1AE | 62 WAGGA 330 - 330KV A CB BAY | EC00003902 | 330 |
| SWSJDA1AE | 62 WAGGA 330 - 330KV A CB BAY | EC00003906 | 330 |
| SWSJDA1AE | 62 WAGGA 330 - 330KV A CB BAY | EC00003908 | 330 |
| SWSJDA1AD | 060 WODONGA 330KV B CB BAY | EC00003846 | 330 |
| SWSJDA1AD | 060 WODONGA 330KV B CB BAY | EC00003847 | 330 |
| SWSJDA1AD | 060 WODONGA 330KV B CB BAY | EC00003882 | 330 |
| SYSCA12J | 4X22 SPARE 132KV FEEDER | A02206/1 | 132 |
| CMSSYS1H1 | 11 DAPTO 330KV FEEDER BAY | BESS61/6 | 330 |
| CMSSYS1H1 | 11 DAPTO 330KV FEEDER BAY | H70734/1 | 330 |
| NTSNB24F2 | 882 WEE WAA 66KV CB BAY | ETA1821 | 66 |
| NTSNB24F2 | 882 WEE WAA 66KV CB BAY | ETA1822 | 66 |
| NTSNB24G2 | 878 BOGGABRI 66KV CB BAY | ETA1818 | 66 |
| NTSNB24G2 | 878 BOGGABRI 66KV CB BAY | ETA1819 | 66 |
| SWSWG12J | 99X WAGGA 132KV SS - 132KV FEEDER BAY | A07109/2 | 132 |
| SWSWG12Q | 99W WAGGA 132KV SS - 132KV FEEDER BAY | A07110/2 | 132 |
| SWSLT11J1 | L5 Tumut 3 330kV Feeder Bay (Units 5-6) | ETA6474 | 330 |
| SWSLT11J1 | L5 Tumut 3 330kV Feeder Bay (Units 5-6) | ETA6475 | 330 |
| SWSLT11J1 | L5 Tumut 3 330kV Feeder Bay (Units 5-6) | ETA6477 | 330 |
| SWSLT11H1 | L3 Tumut 3 330kV Feeder Bay (Units 3-4) | ETA6479 | 330 |
| SWSLT11G1 | L1 Tumut 3 330kV Feeder Bay (Units 1-2) | ETA6380 | 330 |
| SWSLT11J1 | L5 Tumut 3 330kV Feeder Bay (Units 5-6) | ETA6473 | 330 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| SWSLT11G1 | L1 Tumut 3 330kV Feeder Bay (Units 1-2) | ETA6381 | 330 |
| SWSLT11J1 | L5 Tumut 3 330kV Feeder Bay (Units 5-6) | ETA6476 | 330 |
| SWSLT11G1 | L1 Tumut 3 330kV Feeder Bay (Units 1-2) | ETA6343 | 330 |
| SWSLT11H1 | L3 Tumut 3 330kV Feeder Bay (Units 3-4) | ETA6478 | 330 |
| COSWL12E | 94B BERYL 132KV FEEDER BAY | EC00002978 | 132 |
| CMSSYS1J2 | 13 KEMPS CREEK 330KV A BUS CB BAY | BESS61/8 | 330 |
| CMSSYS1J2 | 13 KEMPS CREEK 330KV A BUS CB BAY | BESS61/2 | 330 |
| CMSSYS1J2 | 13 KEMPS CREEK 330KV A BUS CB BAY | H70735/1 | 330 |
| NNSNEW1M1 | 95 TOMAGO 330 SS - 330KV FEEDER BAY | B01534/1 | 330 |
| NNSNEW1M1 | 95 TOMAGO 330 SS - 330KV FEEDER BAY | A09335/5 | 330 |
| SYSCA11C1 | NO3 TRANSFORMER 330KV CB BAY | EC00020855 | 330 |
| SYSCA11C1 | NO3 TRANSFORMER 330KV CB BAY | EC00007277 | 330 |
| CMSSE12LS | 92Z SYDNEY NORTH TEE 132KV FEEDER BAY | A02014/7 | 132 |
| CMSSE12LS | 92Z SYDNEY NORTH TEE 132KV FEEDER BAY | A02014/8 | 132 |
| CMSSE12LS | 92Z SYDNEY NORTH TEE 132KV FEEDER BAY | A02014/9 | 132 |
| NTSKLK4A | NO1 TRANSFORMER 66KV CB BAY | A08657/1 | 66 |
| NTSKLK4A | NO1 TRANSFORMER 66KV CB BAY | A08657/2 | 66 |
| NTSKLK4A | NO1 TRANSFORMER 66KV CB BAY | A08657/3 | 66 |
| CMSSE12H | B1-B2 132KV BUS SECTION CB 4112 | A02005/9 | 132 |
| CMSSE12H | B1-B2 132KV BUS SECTION CB 4112 | A02005/7 | 132 |
| CMSSE12H | B1-B2 132KV BUS SECTION CB 4112 | A02005/8 | 132 |
| CMSSE12B2 | NO2 TRANSFORMER 132KV B BUS CB BAY CB 4422B | A02005/4 | 132 |
| CMSSE12B2 | NO2 TRANSFORMER 132KV B BUS CB BAY CB 4422B | A02005/5 | 132 |
| CMSSE12B2 | NO2 TRANSFORMER 132KV B BUS CB BAY CB 4422B | EC00024926 | 132 |
| COSMTP1C4 | NO3 TRANS. 330/132/11KV & 330 BUS CONN. | EC00015746 | 330 |
| COSMTP1C4 | NO3 TRANS. 330/132/11KV & 330 BUS CONN. | EC00015750 | 330 |
| COSMTP1C4 | NO3 TRANS. 330/132/11KV & 330 BUS CONN. | EC00015751 | 330 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| NTSNB24BB4 | NO4 66KV BUS SECTION | ETA1939 | 66 |
| NTSNB24BB4 | NO4 66KV BUS SECTION | ETA1940 | 66 |
| SWSWG12K | 993 GADARA 132KV FEEDER | A07109/5 | 132 |
| SWSWG12K | 993 GADARA 132KV FEEDER | A07109/4 | 132 |
| SWSWG12K | 993 GADARA 132KV FEEDER | A07109/6 | 132 |
| SWSWG12J | 99X WAGGA 132KV SS - 132KV FEEDER BAY | A07109/1 | 132 |
| SWSWG12J | 99X WAGGA 132KV SS - 132KV FEEDER BAY | A07109/3 | 132 |
| SWSWG12T | 994 YANCO 132KV FEEDER | A07110/8 | 132 |
| SWSWG12T | 994 YANCO 132KV FEEDER | A07110/7 | 132 |
| SWSWG12T | 994 YANCO 132KV FEEDER | A07110/9 | 132 |
| SWSWG12U | 996 A.N.M. 132KV FEEDER BAY | A07111/3 | 132 |
| SWSWG12U | 996 A.N.M. 132KV FEEDER BAY | A07111/1 | 132 |
| SWSWG12U | 996 A.N.M. 132KV FEEDER BAY | A07111/2 | 132 |
| SWSWG12Q | 99W WAGGA 132KV SS - 132KV FEEDER BAY | A07110/1 | 132 |
| SWSWG12Q | 99W WAGGA 132KV SS - 132KV FEEDER BAY | A07110/3 | 132 |
| SWSWG12P | NO2 132KV BUS COUPLER CB | A07111/6 | 132 |
| SWSWG12P | NO2 132KV BUS COUPLER CB | A07111/4 | 132 |
| SWSWG12P | NO2 132KV BUS COUPLER CB | A07111/5 | 132 |
| SWSLT11G1 | L1 Tumut 3 330kV Feeder Bay (Units 1-2) | ETA6324 | 330 |
| SWSLT11J1 | L5 Tumut 3 330kV Feeder Bay (Units 5-6) | ETA6472 | 330 |
| SWSLT11H1 | L3 Tumut 3 330kV Feeder Bay (Units 3-4) | ETA6471 | 330 |
| SWSLT11H1 | L3 Tumut 3 330kV Feeder Bay (Units 3-4) | ETA6480 | 330 |
| SWSLT11H1 | L3 Tumut 3 330kV Feeder Bay (Units 3-4) | ETA6470 | 330 |
| SWSLT11H1 | L3 Tumut 3 330kV Feeder Bay (Units 3-4) | ETA6469 | 330 |
| SWSLT11G1 | L1 Tumut 3 330kV Feeder Bay (Units 1-2) | ETA6379 | 330 |
| SWSDN28A1 | NO1 11KV/415V AUX TRANSFORMER BAY | EC00016071 | 11 |
| SWSDN28A1 | NO1 11KV/415V AUX TRANSFORMER BAY | EC00016072 | 11 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| SWSDN28A1 | NO1 11KV/415V AUX TRANSFORMER BAY | EC00016070 | 11 |
| SYSCA12J | 4X22 SPARE 132KV FEEDER | EC00001315 | 132 |
| COSWL12J | NO1 SECTION 132KV BUS COUPLER CB BAY | EC00002977 | 132 |
| CMSDPT2E1 | NO4 TRANSFORMER 132KV A BUS CB BAY CB 4442A | EC00005309 | 132 |
| CMSDPT2W | 984 TALLAWARRA 132KV FEEDER | EC00005310 | 132 |
| COSMTP1C2 | 330KV 35 MARULAN MAIN BUS CB BAY | EC00022833 | 330 |
| COSMTP1C2 | 330KV 35 MARULAN MAIN BUS CB BAY | EC00022834 | 330 |
| COSMTP1C2 | 330KV 35 MARULAN MAIN BUS CB BAY | EC00022835 | 330 |
| NNSER06B | NO2 33KV REACTOR | EC00008268 | 66 |
| SYSCA12H | 4X12 SPARE 132KV FEEDER | EC00001310 | 132 |
| SYSCA12H | 4X12 SPARE 132KV FEEDER | EC00001312 | 132 |
| COSWL12E | 94B BERYL 132KV FEEDER BAY | EC00003205 | 132 |
| COSWL12E | 94B BERYL 132KV FEEDER BAY | EC00003206 | 132 |
| CMSSYS2L | 916 KURNELL T CRONULLA 132KV FEEDER BAY | EC00003341 | 132 |
| CMSSYS2L | 916 KURNELL T CRONULLA 132KV FEEDER BAY | EC00003342 | 132 |
| CMSDPT2D2 | NO3 TRANSFORMER 132KV B BUS CB BAY CB 4432B | EC00002780 | 132 |
| CMSDPT2E2 | NO4 TRANSFORMER 132KV B BUS CB BAY CB 4442B | EC00002776 | 132 |
| COSWL12J | NO1 SECTION 132KV BUS COUPLER CB BAY | EC00003208 | 132 |
| COSWL12J | NO1 SECTION 132KV BUS COUPLER CB BAY | EC00003207 | 132 |
| CMSDPT2E2 | NO4 TRANSFORMER 132KV B BUS CB BAY CB 4442B | EC00005306 | 132 |
| SYSCA11C1 | NO3 TRANSFORMER 330KV CB BAY | ETA3231 | 330 |
| SYSCA12H | 4X12 SPARE 132KV FEEDER | EC00001311 | 132 |
| CMSSE12MR | 9M3 WARRINGAH 132KV FEEDER BAY | EC00018748 | 132 |
| SYSCA12J | 4X22 SPARE 132KV FEEDER | EC00001314 | 132 |
| CMSSYS2L | 916 KURNELL T CRONULLA 132KV FEEDER BAY | EC00003343 | 132 |
| COSORG2N | No.1 TRANSFORMER 132kV TIE ORANGE NORTH FORMERLY 948 PANORAMA | EC00003211 | 132 |
| COSBER2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00006041 | 132 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| COSBER2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00006043 | 132 |
| CMSAVS1A | 17 MACARTHUR 330KV FEEDER | EC00003842 | 330 |
| CMSAVS1A | 17 MACARTHUR 330KV FEEDER | EC00003843 | 330 |
| CMSAVS1A | 17 MACARTHUR 330KV FEEDER | EC00003844 | 330 |
| SWSBRG3D2 | X5/3 BALRANALD 220KV FEEDER BAY | EC00014796 | 220 |
| SWSBRG3D2 | X5/3 BALRANALD 220KV FEEDER BAY | EC00014797 | 220 |
| SWSBRG3D2 | X5/3 BALRANALD 220KV FEEDER BAY | EC00014798 | 220 |
| SYSMRU4H2 | 847 BOOROWA 66KV FEEDER BAY | EC00008020 | 66 |
| SYSMRU4H2 | 847 BOOROWA 66KV FEEDER BAY | EC00008066 | 66 |
| COSBER4K | NO2 66KV CAPACITOR BANK | EC00004568 | 66 |
| COSBER4K | NO2 66KV CAPACITOR BANK | EC00004569 | 66 |
| COSBER4K | NO2 66KV CAPACITOR BANK | EC00004570 | 66 |
| SWSDNT3E2 | X5/1 BALRANALD 220KV FEEDER BAY | EC00014790 | 220 |
| SWSBRG3G2 | OX1 RED CLIFFS 220KV FEEDER BAY | EC00014784 | 220 |
| SWSBRG3G2 | OX1 RED CLIFFS 220KV FEEDER BAY | EC00014791 | 220 |
| SWSBRG3G2 | OX1 RED CLIFFS 220KV FEEDER BAY | EC00014793 | 220 |
| SWSDN24H | NO1 CAPACITOR 66KV BAY | ETA4691 | 66 |
| NTSNB24A | NO1 TRANSFORMER 66KV CB BAY | EC00017015 | 66 |
| NTSNB24A | NO1 TRANSFORMER 66KV CB BAY | EC00017019 | 66 |
| NTSGN22B1 | NO2 TRANSFORMER 132KV CB BAY | EC00006286 | 132 |
| NTSGN22B1 | NO2 TRANSFORMER 132KV CB BAY | EC00006287 | 132 |
| CMSDPT2E1 | NO4 TRANSFORMER 132KV A BUS CB BAY CB 4442A | EC00002854 | 132 |
| NTSNB24C | NO3 TRANSFORMER 66KV CB BAY | EC00006853 | 66 |
| NTSNB24A | NO1 TRANSFORMER 66KV CB BAY | EC00017018 | 66 |
| NTSNB24C | NO3 TRANSFORMER 66KV CB BAY | EC00017034 | 66 |
| SWSDN24H | NO1 CAPACITOR 66KV BAY | EC00008062 | 66 |
| NTSMRE4F1 | 881 GARAH TEE ASHLEY 66KV FEEDER BAY | EC00006161 | 66 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| NTSNB24M | 834 NARRABRI 66KV SS - 66KV FEEDER | EC00006854 | 66 |
| SWSFNY2A | NO1 TRANSFORMER 66KV CB BAY | EC00017025 | 66 |
| SWSFNY2A | NO1 TRANSFORMER 66KV CB BAY | EC00017033 | 66 |
| CMSDPT2E1 | NO4 TRANSFORMER 132KV A BUS CB BAY CB 4442A | EC00002855 | 132 |
| CMSDPT2D2 | NO3 TRANSFORMER 132KV B BUS CB BAY CB 4432B | EC00002822 | 132 |
| NTSNB24C | NO3 TRANSFORMER 66KV CB BAY | EC00017020 | 66 |
| NTSMRE4F1 | 881 GARAH TEE ASHLEY 66KV FEEDER BAY | EC00008022 | 66 |
| NTSMRE4F1 | 881 GARAH TEE ASHLEY 66KV FEEDER BAY | EC00008021 | 66 |
| SWSALB2H1 | 997/1 COROWA 132KV FEEDER BAY | EC00006022 | 132 |
| SWSALB2H1 | 997/1 COROWA 132KV FEEDER BAY | EC00006024 | 132 |
| SWSFNY2G2 | 84A JERILDERIE 66KV FEEDER BAY | EC00017017 | 66 |
| SWSFNY2G2 | 84A JERILDERIE 66KV FEEDER BAY | EC00017029 | 66 |
| SWSFNY2G2 | 84A JERILDERIE 66KV FEEDER BAY | EC00017030 | 66 |
| COSBER4S2 | 852 DUNEDOO 66KV FEEDER BAY | EC00006160 | 66 |
| COSBER4S2 | 852 DUNEDOO 66KV FEEDER BAY | EC00004608 | 66 |
| COSBER4S2 | 852 DUNEDOO 66KV FEEDER BAY | EC00008033 | 66 |
| NTSNB24M | 834 NARRABRI 66KV SS - 66KV FEEDER | EC00004576 | 66 |
| CMSDPT2V1 | 988 FAIRFAX LANE TEE 132KV FEEDER | EC00006048 | 132 |
| CMSDPT2V1 | 988 FAIRFAX LANE TEE 132KV FEEDER | EC00006054 | 132 |
| CMSDPT2V1 | 988 FAIRFAX LANE TEE 132KV FEEDER | EC00006046 | 132 |
| NTSNB24F2 | 882 WEE WAA 66KV CB BAY | EC00006855 | 66 |
| SWSDN24H | NO1 CAPACITOR 66KV BAY | EC00008025 | 66 |
| CMSLP12A | 93B WEST LIVERPOOL 132KV FEEDER BAY | EC00013865 | 132 |
| CMSLP12A | 93B WEST LIVERPOOL 132KV FEEDER BAY | EC00013867 | 132 |
| CMSLP12A | 93B WEST LIVERPOOL 132KV FEEDER BAY | EC00013864 | 132 |
| CMSLP12B | 93N WEST LIVERPOOL 132KV FEEDER BAY | EC00013862 | 132 |
| CMSLP12B | 93N WEST LIVERPOOL 132KV FEEDER BAY | EC00013863 | 132 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| CMSLP12B | 93N WEST LIVERPOOL 132KV FEEDER BAY | EC00013866 | 132 |
| SWSALB2H1 | 997/1 COROWA 132KV FEEDER BAY | EC00006011 | 132 |
| SWSFNY2A | NO1 TRANSFORMER 66KV CB BAY | EC00017035 | 66 |
| CMSSYW2N | A1-2 132KV BUS SECTION CB 4102 | EC00006065 | 132 |
| NTSNB24G2 | 878 BOGGABRI 66KV CB BAY | EC00006871 | 66 |
| NTSNB24M | 834 NARRABRI 66KV SS - 66KV FEEDER | EC00004600 | 66 |
| CMSDPT2D2 | NO3 TRANSFORMER 132KV B BUS CB BAY CB 4432B | EC00002820 | 132 |
| CMSDPT2E2 | NO4 TRANSFORMER 132KV B BUS CB BAY CB 4442B | EC00002819 | 132 |
| CMSDPT2W | 984 TALLAWARRA 132KV FEEDER | EC00002817 | 132 |
| CMSDPT2W | 984 TALLAWARRA 132KV FEEDER | EC00002818 | 132 |
| NNSTRE4E | 861 WHITBREAD ST ZONE SS 66KV FEEDER | EC00006869 | 66 |
| NNSWRH2M | 96Y MAYFIELD WEST 132KV FEEDER | EC00020915 | 132 |
| NNSWRH2M | 96Y MAYFIELD WEST 132KV FEEDER | EC00020919 | 132 |
| NNSWRH2M | 96Y MAYFIELD WEST 132KV FEEDER | EC00013933 | 132 |
| NNSKS26S | NO2 33KV BUS SECTION | EC00021996 | 33 |
| NNSKS26U | 7R2 SMITHTOWN 33KV FEEDER | EC00021993 | 33 |
| NNSKS26U | 7R2 SMITHTOWN 33KV FEEDER | EC00021994 | 33 |
| NNSKS26U | 7R2 SMITHTOWN 33KV FEEDER | EC00021995 | 33 |
| SWSDNT3C | NO3 TRANSFORMER 220KV A BUS CB BAY | EC00014783 | 220 |
| SWSDNT3C | NO3 TRANSFORMER 220KV A BUS CB BAY | EC00014786 | 220 |
| SWSDNT3C | NO3 TRANSFORMER 220KV A BUS CB BAY | EC00014799 | 220 |
| SWSDNT3D | NO4 TRANSFORMER 220KV B BUS CB BAY | EC00014785 | 220 |
| SWSDNT3D | NO4 TRANSFORMER 220KV B BUS CB BAY | EC00014792 | 220 |
| SWSDNT3D | NO4 TRANSFORMER 220KV B BUS CB BAY | EC00014795 | 220 |
| SWSALB2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00010117 | 132 |
| NNSTRE4E | 861 WHITBREAD ST ZONE SS 66KV FEEDER | EC00006858 | 66 |
| NNSTRE4E | 861 WHITBREAD ST ZONE SS 66KV FEEDER | EC00006873 | 66 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| NTSINV4J | 733 GLEN INNES 66 - 66KV FEEDER | EC00007931 | 66 |
| NTSINV4J | 733 GLEN INNES 66 - 66KV FEEDER | EC00007938 | 66 |
| NNSKS26S | NO2 33KV BUS SECTION | EC00021998 | 33 |
| NNSKS26S | NO2 33KV BUS SECTION | EC00021997 | 33 |
| SWSDN24M2 | NO6 MOAMA 66KV FEEDER BAY | EC00004132 | 66 |
| SWSDN24M2 | NO6 MOAMA 66KV FEEDER BAY | EC00007527 | 66 |
| NTSINV4J | 733 GLEN INNES 66 - 66KV FEEDER | EC00007944 | 66 |
| NNSPMQ2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00013887 | 132 |
| NNSPMQ2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00013888 | 132 |
| NNSPMQ2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00013894 | 132 |
| SYSCA12E | NO2 132KV CAPACITOR | EC00010106 | 132 |
| SYSCA12E | NO2 132KV CAPACITOR | EC00010099 | 132 |
| NNSTRE4Q | NO4 66KV CAPACITOR | EC00008031 | 66 |
| SWSDN24M2 | NO6 MOAMA 66KV FEEDER BAY | EC00004133 | 66 |
| SWSALB2C1 | NO3 TRANSFORMER 132KV CB BAY | EC00010070 | 132 |
| COSMTP2F | NO3 TRANSFORMER 132KV CB BAY/94Y FDR | EC00013906 | 132 |
| COSMTP2F | NO3 TRANSFORMER 132KV CB BAY/94Y FDR | EC00013909 | 132 |
| COSMTP2F | NO3 TRANSFORMER 132KV CB BAY/94Y FDR | EC00013910 | 132 |
| NNSTRE4Q | NO4 66KV CAPACITOR | EC00007914 | 66 |
| NNSTRE4Q | NO4 66KV CAPACITOR | EC00008039 | 66 |
| COSWL12R | 945 MOLONG TEE WEL'TON TWN 132KV FDR BAY | EC00009100 | 132 |
| COSWL12R | 945 MOLONG TEE WEL'TON TWN 132KV FDR BAY | EC00009094 | 132 |
| NNSWRH2Q | 962 TOMAGO 132 SS - 132KV FEEDER | EC00013924 | 132 |
| NNSWRH2Q | 962 TOMAGO 132 SS - 132KV FEEDER | EC00020912 | 132 |
| NNSWRH2Q | 962 TOMAGO 132 SS - 132KV FEEDER | EC00020913 | 132 |
| SWSALB2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00010100 | 132 |
| COSWL12R | 945 MOLONG TEE WEL'TON TWN 132KV FDR BAY | EC00009098 | 132 |

| Equipment Reference | Equipment Description | PIC Number | Voltage |
|---|---|---|---|
| SYSCA12E | NO2 132KV CAPACITOR | EC00010101 | 132 |
| SWSGRF2K | 99J YANCO 132KV FEEDER | EC00006018 | 132 |
| SWSGRF2K | 99J YANCO 132KV FEEDER | EC00006036 | 132 |
| SWSGRF2K | 99J YANCO 132KV FEEDER | EC00009345 | 132 |
| SWSALB2B1 | NO2 TRANSFORMER 132KV CB BAY | EC00010059 | 132 |
| SWSALB2C1 | NO3 TRANSFORMER 132KV CB BAY | EC00005993 | 132 |
| SWSALB2C1 | NO3 TRANSFORMER 132KV CB BAY | EC00009349 | 132 |
| COSMPP1B2 | NO2 TRANSFORMER 132/66KV TRANSF BAY | EC00007426 | 66 |