Documenting Electrical Operations

Presenter: Craig Tooke
Session Secretary: Phil Bertram

Introduction

Paper work don't you just love it?

It seems as we progress towards the twenty first century and the supposed paper less society we are more and more becoming reliant on paper work.

In our museum operations we tend to document certain areas of our operation in the day-to-day running of our museums very well.

Such an example is traffic operations where we have a running journal showing passenger and ticket numbers completed after each journey recorded on.

As museums we must increasingly become aware that other areas of our operations must in the future be documented in far greater detail than perhaps we have tended to do in the past.

This paper will examine the area of museum electrical operations and some of the documentation that should be routinely completed and kept.

Why Document Electrical Operations?

We now live in the era of quality assurance and accreditation whether we wish to or not this has become a fact of life.

All organisations whether they are large or small are being increasingly called upon by Government legislation to ensure that quality systems are in place and used for all facets of the organisations operations.

Currently the Public Transport Corporation is going through this very process of documenting it's procedures and by experience I must say that it is not all that easy to sit down and say well we have been doing the task for seventy years now but how do we do it and documenting the procedures that we use.

All museums will be eventually responsible under rail safety accreditation legislation to ensure that adequate systems of documentation and quality assurance are in place for all facets of our operations.

Quality assurance is about ensuring that expected outcomes are achieved in the safest and most efficient manner.

Electrical operations form a vital part of a tramway museums operation and as such there is a great and important need to ensure that correct documentation occurs.

What Needs To Be Documented?

Care needs to be taken in the extent to which documentation of electrical operations is carried out.

If taken to the ridiculous extremes it can be documentation can be time consuming and of little benefit in quality assurance and safety enhancement.

By and large documents used in electrical operations tend to fall into one of two categories;

- Reference documents
- Reports
- As tramway museums we I believe that we should ensure as a minimum that we fully document the following aspects of electrical operations;
- Electrical switching operations

- Damage to overhead and subsequent repair information
- Maintenance or repair work to substation plant
- Electrical switching procedures
- Electrical system configuration
- Routine test results and inspection information

How Should the Documentation be Presented?

There are no hard and fast rules in place that can be applied to the preparation and recording of electrical system documentation, however there are a few important guidelines that should be observed when preparing documentation:

- The documentation should be written in a clear and precise manner, using plain English
- It must be able to be identified by a unique form of identification
- It should be prepared in a controlled manner and distributed in a controlled manner
- It should be capable of being audited if necessary
- It should comply with any statutory requirements that may be applicable
- It must be in a form authorised by the museum board or responsible officer
- It should always be signed and dated
- It should be as simple and as uncomplicated as possible

As I have mentioned earlier in the paper electrical operations documentation need not be necessarily complex, time consuming or complicated.

At Haddon we use a simple log book contained inside the substation located in a pocket on the door to record all electrical switching operations.

This log book provides an accurate record of all work that is undertaken on the museum electrical system and it also provides a means by which special instructions can be issued to members responsible and authorised to carry out electrical operations by the responsible officer of the museum.

I refer and commend to you all the COTMA Electrical Safety Rules which provide a further suggested guide to some of the requirements that each museum should have in place in the area of electrical operations.

Typical examples of documentation used in electrical operations by the Public Transport Corporation are contained on the following pages as a guide to the sort of documentation that is used.

We will now pause and examine some of this documentation.

It should be noted that there are variations on these documents used by other organisations however they are largely similar right throughout the power supply and distribution industry.

Storage of Documentation

It is essential that electrical operations documentation be stored in a safe and secure manner protected from the elements and capable of being easily obtained by those who require access to them.

As with the preparation of documentation there are no set methods or rules for storing documentation, each museum should come up with a system that meets their needs.

All documentation particularly that which pertains to electrical switching operations should be kept for the minimum five year statutory period.

Accurate records should be kept detailing the location of any documentation relating to electrical operations.

Security of storage is essential to ensure that electrical operations records are available as and when required.

It is also suggested that multiple copies of essential documentation be kept at more than one location to protect against accidental loss.

Training

Once a system of documentation has been put into effect it is essential to ensure those who will be using and in deed providing the information are well versed in the procedures to be followed when using and completing documentation.

A system of documentation will only prove of value if the information contained within it can be readily and accurately accessed as and when required.

This process may invoke the development of procedures and instruction relating to how the documentation is to be used, stored and added to.

Care must be taken to ensure all who are required to utilise the system are aware of how it operates.

Conclusion

With this presentation I have attempted to illustrate some of the broad principles behind the requirements for documenting electrical operations and just how this practise is carried out in industry.

Rail safety accreditation legislation is fast becoming a reality and as such as museums we must become more and more professional in all aspects of our operations including documenting what we do and how we do it.

Electrical operations documentation has tended in the past to be an area which only a few people at each museum were interested in or were pro-active in seeing being carried out.

It is of vital concern that we all become far more pro-active in this area and in deed in the documentation of all our operations to ensure we comply with the complexity and reality of modern legislation such as rail safety accreditation.

I wish to suggest that this perhaps could be an area in which COTMA as an organisation could perhaps play an active role in.

It would be of value if we all had the one set of electrical operations documentation or at least documentation that was very similar in layout and content.

Similar rail safety legislation will be shortly in place in most states of Australia and in New Zealand.

Why not pool our resources and collectively come up with systems that work for our type museum?

I wish to close by asking you all to review my comments and I invite further discussion on this matter either now or during the conference.

Questions/Comments

Q: Permits for overhead work — are different permits required for live and dead sections of overhead? Yes

Q: What do the various museums do for electrical procedures?

Barry Ollerenshaw: Wellington has a "Power Book" as current record of Electrical work to ensure workers are aware of System Status. A supervisor is responsible for overseeing operations.

S Parker: At PETS Power Switches are key locked and logged by persons performing work.

Q: Do you keep records? No written records are kept of work being performed

John Bullen: Bendigo — no registered electrical contractor is employed to take responsibility for work until such terms they are reluctant to sign any documentation until someone is available. Staff are confident but not officially authorised

W Doubleday: BTM has had problems coordinating electrical works with the SEC to ensure safety checks have been followed.

Q: How far have museums gone with their reference documentation?

WTM Barry Ollerenshaw: have issued power procedure documents. Staff are trained and cannot operate without this training. Further documentation is under preparation.

BTM Bill Kingsley: — no records are taken of power switching, are on/off records required? Yes, records of this activity are recommended for all museums. Some form of pre-testing of the system prior to power on is also highly recommended.

Jim McCrum: Is labelling of all switching required? Yes, highly recommended, and is becoming mandatory.

Barry Ollerenshaw, under OH&S (NZ), when a risk is identified you are compelled to do something about it.

Craig Tooke: Documentation of day-to-day operations is recommended for your operations and activities.

John Bullen: Experience from industry has proven that we must test and record equipment testing.

CARLTON ELECTRICAL CONTROL
TRAM ELECTRICAL SYSTEM
ISOLATION PROGRAM

I.P. 0079
Page 1 of 1
Continued on Log(s) —
Date: 16 / 8 / 96 Day: FRIDAY

From SATURDAY (day) the 17 / 8 / 96 at 00:30 Hrs to SATURDAY (day) the 17 / 8 / 96 at 04:00 Hrs
The isolation of D1, D2 & D3 FEEDER CABLES is required
From pole 7A WHITEHORSE RD
To pole SUB D
For :- INSTALLATION OF CABLES INSIDE SUB D FOR NEW TOU UNIT

Contact name:- MARIO CACILIA of TRAM SUBSTATIONS Contact No :- 0414511511
Last tram : Hrs First tram :- : Hrs Depot(s)
Isolation to be carried out by :- F'MAN CACILIA & SUBSTATION STAFF Commenced at :-23:59 Hrs Completed at :00:30 Hrs
Restoration by :- F'MAN CACILIA & SUBSTATION STAFF Commenced at :03:40 Hrs Completed at :04:13 Hrs
Application No :- 163 Permit type ACCESS Permit No :- 71 issued at:-00:52 Hrs Date:17 /8 /96
Issued to :-
Permits on Issue :- ACCESS
Permit No(s) :- 71 Recovered at : Hrs Date __ / __ / __
Hold Card No NOT REQUIRED Attached by :- At : Hrs Date: __ / __ / __
Removed by :- At : Hrs Date: __ / __ / __
Power off Notification given by :- (NOT NECESSARY) Time : Hrs Date: __ / __ / __

		Time
	ISOLATION — ph R.L	19:40
	1 RG AFTERNOON SHIFT TO JUMPER THE S/S's P81 COTHAM RD	
	2 ISOLATE SUB D AUX PANEL ON #108, #189A & SWITCH #189B DOWN ONTO THE AUX BUS	23:59
	3 OPEN D1, D2 & D3 FEEDER PANELS ON #108, #189A & CHECK FOR INCOMING VOLTAGE	00:01
	4 BREAK THE BOLTED CONNECTIONS IN D1, D2 & D3 FEEDER CABLES P7A WHITEHORSE RD	00:35
N	5 CHECK FOR ZERO INCOMING VOLTAGE ON D1, D2 & D3 FEEDER PANELS	00:36
	6 SWITCH #189B D1, D2 & D3 FEEDER PANELS DOWN ONTO THE AUX BUS	00:38
	7 TEST SUB D AUX BUS DEAD & ATTACH A SHORT CIRCUIT TO #189B D1 FEEDER PANEL	00:42
	8 ISOLATE "A" & "B" UNITS ON #5, #8, #8x, #71, #52 & H.T. LINKS	00:50
	9 ISSUE AN ELECTRICAL ACCESS PERMIT N° 71 ISSUED AT	00:52
	RESTORATION	
	1 CANCEL THE ELECTRICAL ACCESS PERMIT N° 71 CANCELLED AT	03:40
	2 REMOVE THE SHORT CIRCUIT FROM #189B D1 FEEDER PANEL	03:40
	3 RESTORE "A" & "B" UNITS ON H.T. LINKS, #52, #71, #8x, #8 & #5	03:44
	4 CLOSE D1, D2 & D3 FEEDER PANELS ON #189B, #189A & #108. CHECK CONTACTORS CLOSED	03:45
	5 REISOLATE D1, D2 & D3 FEEDER PANELS ON #108 & #189A	03:46
	6 RECONNECT THE BOLTED CONNECTIONS IN D1, D2 & D3 FEEDER CABLES P7A WHITEHORSE RD	03:59
	7 CHECK FOR INCOMING VOLTAGE ON D1, D2 & D3 FEEDER PANELS	04:00
	8 CLOSE D1, D2 & D3 FEEDER PANELS ON #189A & #108. CHECK CONTACTORS CLOSED	04:01
	9 DISCONNECT THE JUMPERS ACROSS THE S/S's P81 COTHAM RD	04:10
	10 TEST FOR STUB END CONDITIONS ON D3 FEEDER PANEL OV.	04:12
	11 RESTORE SUB D AUX PANEL ON #189B, #189A & #108	04:13
	DETAILS ENTERED ON P.C.	

PUBLIC TRANSPORT CORPORATION.

ELECTRICAL OPERATIONS TROUBLE DOCKET

60148

Reported by F.O.C		At 08 : 42 Hrs	DATE 28 : 8 : 96
Street SWANSTON ST/LATROBE ST		Route : COMMON	Up / Down
Pole No 183	Reported to R / At 08 : 42 Hrs	Arr 09 : 15 Hrs	CL 9 : 38 Hrs
Weather :	Rain Yes ☐ No ☐	Windy Yes ☐ No ☐	Temperature ___ °C

OVERHEAD DEFECTIVE FITTINGS			DUE TO SPEED Yes ☐ No ☐		
1 BROKEN SPAN	1A PARAFIL	1B STEEL	2 POLES DEWIRE	3 CLIP AWAY	4 FROG
5 TAP	6 CROSSING PAN	7 TROUGHING	8 TRIP SWITCH	9 LINE CONTACTOR	10 SPLICE EAR
11 S/I DEFECTIVE	11A S/I DAMAGED	11B INSERT MISSING	12 OVERHEAD OBSTRUCTION	12A ROPE	12B OTHER
13 PANTOGRAPH FITTINGS	14 PANTOGRAPH DAMAGED	15 RAIL SQUARE	16 AUTO POINTS	17 KINK IN TROLLEY	18 MISCELLANEOUS

19 TROLLEY DOWN	19A BROKEN	19B PULLED FROM FITTING	20 FEEDER CABLE TROUBLE	21 A.C. MAIN ON OVERHEAD
22 POLE DAMAGE	22A VEHICLE IMPACT	22B UNSTABLE FOOTING	23 A/Sw DAMAGE	24 CABLE OFF INSULATOR

REMARKS & REPAIRS SPAN INSULATOR BROKEN AND HIT TRAM WINDSCREEN AFTER POLE OF TRAM 851 DEWIRED
BROKEN INSULATOR REPAIRED
DELAY TO SERVICE 08.40 TO 08.50 (10 MIN)
10 TRAMS ON THE DOWN DELAYED.

POWER OFF	Yes ☐	No ☐	Hrs ___	Minutes ___	Total ___ SECTION ___
DELAY	Up ☐	Down ☑	Hrs ___	Minutes 10	Total 10 SECTION C7

P.C.O. 2/3 Angelo Manos

This Card Must Not be Removed
Nor this Apparatus Operated
without permission from
Carlton Electrical Control

"HOLD" CARD

Location.....ID No.....Log No.....
Apparatus affected and reason for issue.....
.....
.....
Isolated on #'s.....
.....
.....
.....
.....
Short circuits attached YES / NO
.
Card attached by (Sig).....Grade .....
Date.....Time.....Hrs
Duty PCO3.....
Permission to remove card given by.....
Duty PCO3.....Time& Date.....
Card Removed by(Sig).....Grade.....
Date..../.../.....Time.....Hrs

Completed Card Must be Returned
to Carlton Electrical Control
Phone 96103394 / 96103395

THIS CARD MUST NOT BE REMOVED

"HOLD"

CARD

NOR THIS APPARATUS OPERATED
WITHOUT PERMISSION FROM
CARLTON ELECTRICAL CONTROL

Carlton Electrical Control HOLD CARD No 1348

Log No.....

Location.....**Date..../..../.....**

.....

Apparatus Affected & Reason for Issue.....

.....

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.....

Apparatus Isolated on #'s.....

.....

.....

.....

Short Circuits attached on.....

.....

.....

..... Time .....Hrs

Card Attached by. Name.....Grade.....Time.....Hrs

SCADA Tag attached...:....Hrs.Date../.../ ...Removed.....:....Hrs.Date.../.../..

COMPLETE THIS SECTION BEFORE REMOVING HOLD CARD

Permit on Issue Y/N Type..... .....No.....

Permit Issued at. Time.....Hrs. Date..../.../.....

Recipient of Permit.....Grade.....

Dept. or Company name.....

Permit Cancelled .....Hrs Date..../.../.....

Cancellation Received by: Name.....Grade.....

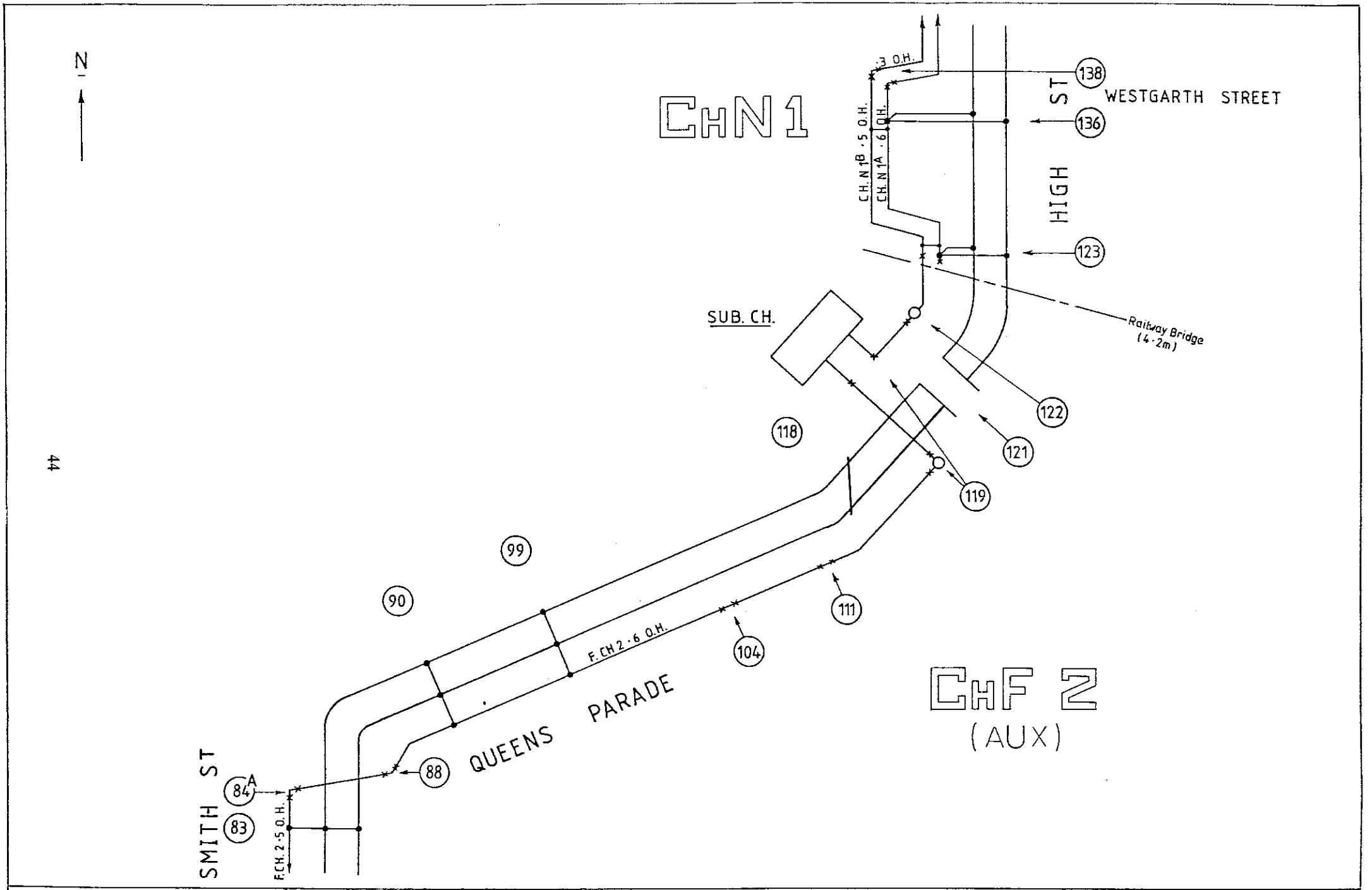
Permission to remove Card given by PCO3.....at.....Hrs

Hold Card Removed at.....Hrs. Date..../.../...

Short Circuits Removed at.....Hrs. Date.../.../...

Removed by Name..... .....Grade.....

Completed card received at....:...Hrs. Date.../.../....By.....



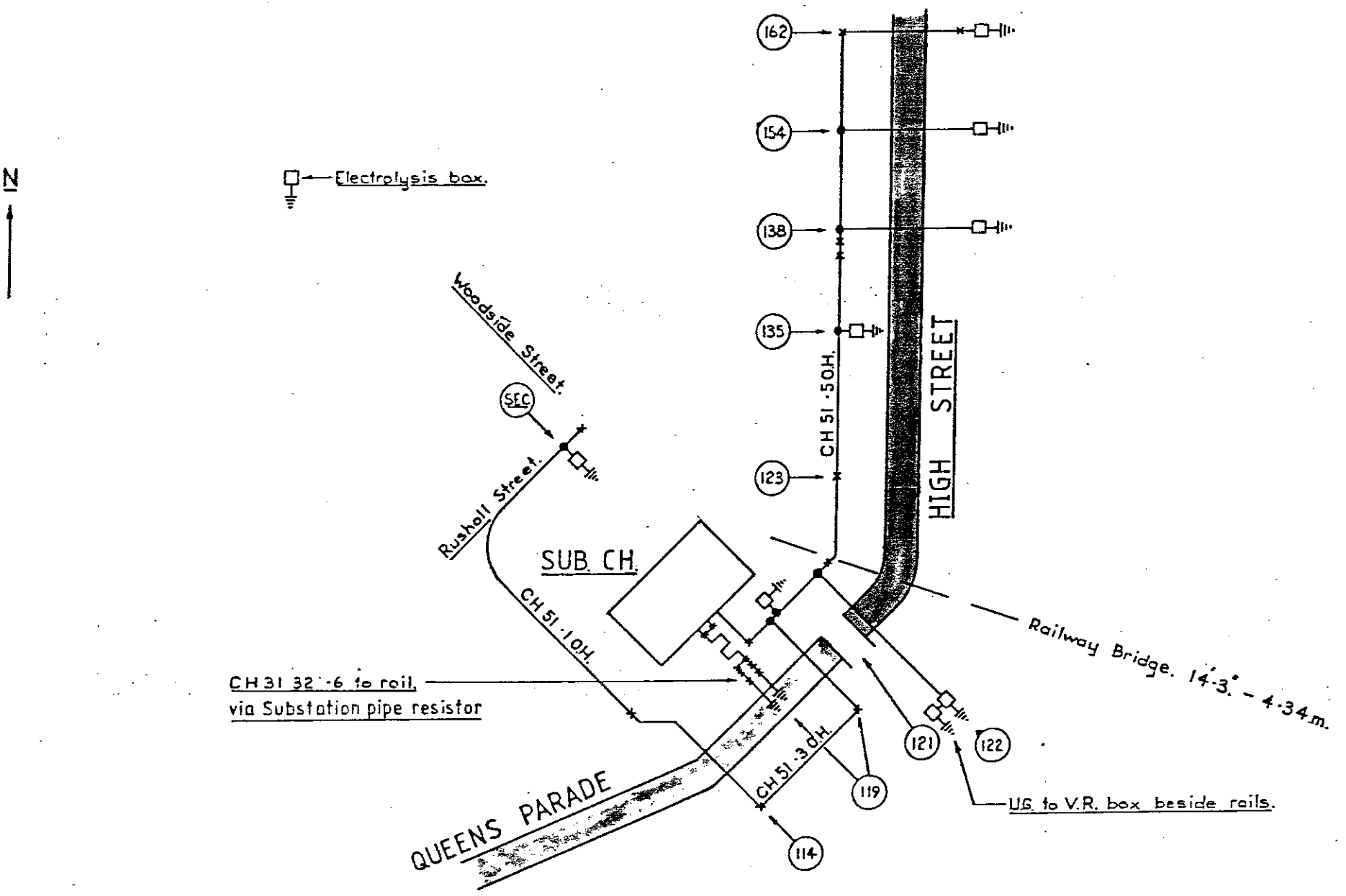
44

JUNE 91 DATE				
DRAWN CH	CHECKED	PASSED	APPROVED	

POSITIVE FEEDER CONNECTIONS
SUBSTATION CH

METROPOLITAN TRANSIT AUTHORITY OF VICTORIA

0 13-168 C



DATE	CHIEF ENGINEER		
DRAWN	CHECKED	PASSED	APPROVED

NEGATIVE FEEDER CONNECTIONS SUBSTATION CH

METROPOLITAN TRANSIT AUTHORITY OF VICTORIA

0 14-107

CARLTON ELECTRICAL CONTROL
TRAM ELECTRICAL SYSTEM

095950

Date: 1/8/96 Day: THURS

SUB. RV F'MAN CACHIA IS IN ATTENDANCE WITH A S&C REPRESENTATIVE TO INSPECT DEFECTIVE MCB. F'MAN CACHIA ADVISES INSPECTION COMPLETE. MODIFICATIONS WILL BE MADE TO MCB BEFORE IT CAN BE RESTORED TO SERVICE. — 7:52 — 8:26

METER READING. CITIPOWER STAFF WILL ATTEND AT SUBS. D, KW, S, CW H, W, CH, F, Y = N TODAY. — 7:56

TD 59997-9 ST KILDA/COMMERCIAL RDS. LINE CONTACTOR DAMAGED, DOWN TRACK. R1 NOT: 9:22 (R1 BUSY – SEE BELOW. R2 NOT.). R2 STRAIGHTENED BARS ON LINE CONTACTOR. — 9:22 — 11:18

TD 59998-19A P. 54 ST KILDA RD, DOWN TRACK. REPORTED AS PROBLEM WITH TROLLEY. R1 NOT: 9:24 ARR. 9:40 CL. 10:47
FOC ADVISE TROLLEY BROKEN + WRAPPED AROUND TRAM POLE. — 9:24 — 9:27
KW ST 2 PANELS OPENED PER S/V. (SEE LINE 44) — 9:28
R1 = FOC NOTIFIED RE POWER OFF. — 9:29
R1 REQUESTED TO TEST TROLLEY DEAD ON ARRIVAL. — ~.
O/S JONES NOTIFIED + WILL NOTIFY J. UITGEWIJK. F'MAN WILLS NOT. — 9:37
R1 ADVISES TROLLEY TESTED DEAD, BUT UNABLE TO COMMENCE REPAIRS UNTIL R10 MOVES TRAM 800 WHICH IS DIRECTLY UNDER THE BREAK. R10 EN ROUTE. — 9:40
R1 ADVISE TRAM HAS BEEN MOVED + THEY WILL COMMENCE WORK. — 9:55
R1 ADVISE OK TO RESTORE POWER. — 10:02
KW ST 2 PANELS CLOSED PER S/V AT 10:02. R1 = FOC NOT RE POWER ON.
R1 ADVISE POLES WILL HAVE TO BE PULLED UNTIL REPAIRS ARE COMPLETED. FOC NOT — 10:03
POWER OFF FROM 9:28 – 10:02 (34 MINS). O/S NOT: F'MAN WILLS NOT.
R1 ADVISE WORK COMPLETED. 2 SPLICE EARS, SEVERAL HANGERS AND SHORT SECTION OF TROLLEY USED FOR REPAIRS. FOC NOT. — 10:47
FOC ADVISE T11 WAS INVOLVED. MANY TRAMS WERE DIVERTED.
DEL SUM FAXED. — 11:16

S/V TD 2571
SUB. ST ST 2 PANEL INDICATED MAGENTA WHEN OPENED PER S/V. — 9:28
PCO'S DODDS + MAGALAS REQUESTED TO CHECK. ARR. 9:54 — 9:30
TRANSDUCER INDICATING ZERO.
PCO DODDS ADVISES ST2 PANEL WAS OPEN ON ARRIVAL.
~ ~ ~ MOUSETRAP CONTACTS CLEANED + ADJUSTED. — 10:03
CONTROL + INDICATION CHECKED OK.

Date: 1/8/96 Day: THURS 095950

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

PUBLIC TRANSPORT CORPORATION

TRAM AND BUS INFRASTRUCTURE

ELECTRICAL ACCESS PERMIT No.: 00599

Carlton Electrical Control Operations Superintendent ph: 9610 3391 Power Control Operators ph: 9610 3394

Work may be performed on the described Apparatus only while this Access Permit is on issue. The switching, isolating, earthing and other precautions which have been taken to make this Apparatus safe will remain unchanged during the currency of this Access Permit.

1. References: Application for Permission to Work No.: 479 Carlton Control Log No.: PC085
   Other:.
2. Location: BURKE RD CAMBERWELL
3. Apparatus to be Worked on: OVERHEAD TROLLEY WIRE AND SPAN WIRES BETWEEN POLE 73 AND POLE 17 BURKE RD
4. Protection, Isolation and Earthing: CW5 FEEDER PANEL ISOLATED + RACKED OUT IN SUB CW. SHORT CIRCUIT ATTACHED TO CW5 FEEDER CABLE IN SUB CW, TROLLEY WIRE REMOVED SOUTH OF POLE 17. BATTENS + POWER OFF SIGNS ATTACHED ON NTH SIDE OF S/S @ 73 BURKE RD, LOCAL SHORT CIRCUITS ATTACHED AT P72 AND P17 BURKE RD.
5. I, JEFF HILDER Grade PCO2 Level A AEO No. 18
   certify that the condition of protection, isolation and earthing is as detailed above and the Apparatus is safe to work on
   (signed) [signature] Date 27/8/96 Time 00:33 am/~~pm~~
6. I hereby acknowledge receipt of this ACCESS PERMIT and fully understand and accept the condition that the status of protection, isolation and earthing described above must not be changed during the currency of this Access Permit
   RECIPIENT IN CHARGE Name Steve McGuire CP No./AEO No.
   (signed) [signature] Date 27/8/96 Time 00:33 am/~~pm~~ (phone) 0411256879
7. Signature of members of work party who require access to apparatus

		AppP No/CP No AEO No.
1.	[signature]	
2.		
3.	[signature]	
4.		
5.	[signature]	
6.		
7.	[signature]	
8.	[signature]	
9.		
10.	[signature]	

8. I hereby relinquish this ACCESS PERMIT and state that henceforth the apparatus is not safe to approach Date 27/8/96 Time 05:20 am/~~pm~~
   RECIPIENT IN CHARGE –
   (signature) [signature]

1.	[signature]
2.	
3.	[signature]
4.	
5.	[signature]
6.	
7.	[signature]
8.	[signature]
9.	
10.	[signature]

9. I have advised Carlton Electrical Control and with its approval I cancel this ACCESS PERMIT
   (Sign) [signature] (Name) FLOET (Date) 27 8/96 (Time) 5.20 am/pm

AEAP1.WKT 18/04/95

Mr. Cameron: Control Room:

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD

CLIFTON HILL SUBSTATION

ISSUED 10th JANUARY, 1955

INSTRUCTIONS FOR OPERATING B.C.E. SINGLE CYLINDER 600 K.W. RECTIFIER

INSTRUCTION SHEET No.31.1.55

SPECIAL NOTE:- The RECTIFIER CYLINDER and POWER TRANSFORMER are ALIVE whenever the O.C.B, Device 52, is CLOSED. The NORMAL condition for the unit is for the O.C.B. to be left CLOSED whether the unit is ON LINE or NOT. The O.C.B. can only be opened by A.C. overload, Cabinet insulation failure, Manual tripping, Operation of Anode fuse striker pin relays or Back fire indicator devices. NO SIGNAL LAMPS are installed in this Substation. It is necessary to observe the position of the mechanical ON-OFF indicator on the O.C.B. mechanism to ascertain if the POWER TRANSFORMER and RECTIFIER CYLINDER are ALIVE.

TO START:- Assuming Plant to have been Isolated

1A See that the Rectifier Negative Switch (on the North wall of the Substation to the Left of the front door) is closed.

2A See that the Iron Clad Switch on the Fan control panel is closed, that the Triple Pole Knife Switch, device 29, is in its TOP contacts and that device 10 is in the Unit A Leading Position.

3A See that the Emergency Switch (on the North wall of the Substation to the Left of the front door) is closed.

4A Close the Rectifier H.T. Links No.3 in Cubicle T.

5A Close the O.C.B., device 52, as follows:- The hand resetting lever should be fully inserted and depressed as far as possible until it is finally arrested by the mechanism. It will be noticed that the spring release prop engages under the roller before the hand lever reaches the end of its travel. This surplus movement is to ensure resetting of the trip mechanism. The hand lever should be allowed to return until the spring load is taken up by the prop and then removed from the mechanism. The mechanism can now be operated by the Lanyard which will pull away the prop. It should be remembered that this operation ACTIVATES the Power Transformer and the Rectifier Cylinder.

6A Close the manual D.C. circuit breaker, device 71.

7A Close device 8X and device 8.

8A Close device 5.
After a delay of approximately 2 minutes (while device 2 completes timing) the Rectifier should start.

TO SHUT DOWN and COMPLETELY ISOLATE EQUIPMENT

1B Open device 5.

2B Open device 8 and device 8X.

3B Open the manual circuit breaker, device 71.

4B Open the OCB, device 52, by pressing the button marked TRIP on the operating mechanism. IMPORTANT NOTE:- The Rectifier Cylinder and Power Transformer remain ALIVE until the O.C.B., device 52, has been TRIPPED MANUALLY.

5B After the O.C.B. has been tripped manually open the Rectifier H.T. Links No.3 in cubicle T.

6B Open the Rectifier Negative Switch.

E.12-386