□ Electrical □ Mechanical □ Water Meters
25 Bunya Street Eagle Farm Q 4009
Ph. (07) 3403 1849
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30th May. 1999

OPERATING MANUAL FOR:

HOCKINGS ST. RIVER CROSSING

TWIN SEWER MAINS

CATHODIC PROTECTION SYSTEM

CLIENT:

BRISBANE WATER OPERATIONS
ASSET MAINTENANCE

MANUAL CONTENTS

DRAWINGS

(1.0) INTRODUCTION

Steel when immersed or covered in water has a tendency to corrode (or rust) as the oxidized form is more stable than the metal.

Because of this, precaution must be taken to stop or minimize the corrosion reaction to an acceptable level consistent with the design life of the structure. This is normally achieved by the use of protective coatings which control the corrosion reaction by isolating the steel from its surrounding environment.

However, it is not practical to achieve a perfect coating and coating damage will always occur with time. Because of this, corrosion may occur at imperfections in the paint coating, causing further deterioration in the coating as well as loss of metal.

As a result of this, the coating defects must be rectified by periodic maintenance or an additional method of protection used to prevent this deterioration and corrosion occurring. This additional protection is achieved by the cathodic protection system.

(2.0) CORROSION AND CATHODIC PROTECTION

Corrosion is an electrochemical process in that it is accompanied by a flow of electrical current.

Corrosion occurs on the surface of metals at active areas known as anodes, which are electrically continuous with less active or passive areas known as cathodes. The electric current flows from the anode through the electrolyte to the cathode, with the circuit being completed by the electrical continuity between the cathode and anode. In practice anodes and cathodes are generally part of the same metallic surface and individual anodic areas may be small.

In applying cathodic protection an external current is applied to the surface so that the entire surface to be protected acts as a cathode. This involves the use of an auxiliary anode and when the current flow from this anode is sufficient, no part of the structure acts as an anode.

An external source of direct current such as a transformer rectifier is used in conjunction with an anode consisting of material with a very slow corrosion rate.

While it is the flow of current which achieves the cathodic protection of the surface it is impractical to measure these currents over individual anodic areas to determine when cathodic protection has been achieved. However, with the flow of cathodic protection current, the structure becomes more negative with respect to the surrounding electrolyte. Because of this, it is possible to state values of metal/electrolyte potential at which corrosion does not occur. This metal/electrolyte potential is generally measured against a standard reference electrode which allows a reproducible potential at which corrosion does not occur to be quoted.

(3.0) MAINS DETAILS

Size:	Twin 450 mm dia mild steel cement lined.
Coating:	Tar Epoxy.
Length:	Appox 250 metres.
Location:	From Hockings Street Syphon West End, to Coronation Drive Milton.

Construction Drawings:

486/6/6-SQ1T0001E	Cathodic Protection Rectifier Unit.

(4.0) CATHODIC PROTECTION DETAILS

(4.1) Type of Cathodic Protection: Impressed Current.

(4.2) Rectifier: Standard 32 Volt, 12. 5 amp direct current output enclosed in a stainless steel switchboard. This system has a rectifier installed outside the building at the Hockings Street Syphon, and has a 240V supply from the distribution board at the Syphon.

(4.3) Cathode: The cathode points are located on the 450 mm dia mains, in the wet well at the Hockings St. syphon. The cathode point is where the cabling from the rectifier is attached to the structure under cathodic protection.

(4.4) Anodes: Three 1500 x 75mm silicone iron anodes were installed approximately 50 metres from the rising sewer mains, in a vertical bed approx. 3 metres deep, on the western side of the main, in the park land between Riverside Drive and the Brisbane River.The anodes are backfilled with cokebreeze thereby improving anode – ground resistance. The anodes are identified by a label in a pit at the anode location.

(4.5) Test Points: Test points are installed on cathodically protected structures to enable testing to ensure full protection of the mains. On these mains one test point has been installed and it is located in the rectifier. A zinc reference has been installed on each main at the ball joint approx. 30 metres into the Brisbane River. A copper/copper sulphate reference has been installed on the main (under the electrical pit) adjacent to the pathway.

Note: At the time of commissioning no potential readings were taken at the Coronation Drive end.

(4.6) Associated Drawings:
Standard Rectifier Wiring Diagram – 486/6/25–AA1C0021E

(4.7) Associated Standards:
AS 3000 1991 Australia Wiring Rules
AS 2832.1 1991 Pipes, Cables, Ducts, Guide to Cathodic Protection, Part One.

(4.8) Government Regulations:
Queensland Electricity Acts and Regulations.

(5.0) PERFORMED TESTING

(1) Natural Potential Survey.

(2) Testing of Insulated Flanges, Joints.

(3) Soil Resistance Testing.

(4) Current Drain Survey.

(5) Pipe Coating Anomaly Survey.

(6) Rectifier Loop Resistance.

(7) Foreign Structure Interference Survey and Mitigation.

(8) Final Potential Survey and Commissioning.

(6.0) CONCLUSION

Full Cathodic protection has been achieved on this section of sewer mains. The cathodic protection system is registered with the Electrical Safety Office, Department of Mines and Energy, and has approval to operate.

(7.0) MAINTENANCE

The cathodic protection system is maintained on a monthly basis after commissioning. These checks involve testing rectifier operation and recording of pipe to soil potentials.

30th May 1999
Electrical Engineering Unit.
Cathodic Protection

CPS Monthly Maintenance Details.

Required:

1/ Notify plant operator and/or sign entry logs where necessary.
2/ Have appropriate keying.

Labour:

One tradesperson, one vehicle. 20 minutes per site.

Procedure:

1/ Identify installation.
2/ Check system for operation.
3/ Record voltmeter.
4/ Record ammeter.
5/ Comments.
6/ Log entry.

30th May 1999
Electrical Engineering Unit.
Cathodic Protection

CPS 6 Monthly Maintenance Details.

Required:

1/ Notify plant operator and/or sign entry logs where necessary.
2/ Have appropriate keying.
3/ Set of tools. (Electricians)
4/ Multimeter.
5/ DC clampmeter.
6/ Copper sulphate reference cell and leads.
7/ Cleaning equipment.
8/ Gatic cover lifters.

Labour:

One tradesperson electrical, one laborer, one vehicle.
Two hours per site.

Procedure:

1/ Identify system.
2/ Check system for operation.
3/ Record voltmeter.
4/ Record ammeter.
5/ Record "on" potentials for all test points.
6/ Record "instant off" potentials for all test points.
7/ Record "off" potentials for all test points.
8/ Perform loop resistance and record.
9/ Check and record anode string currents.
10/ Comments.
11/ Log entry.

30th May 1999
Electrical Engineering Unit.
Cathodic Protection

CPS 60 Monthly Maintenance Details.

Required:

1/ Notify plant operator and/or sign entry logs where necessary.
2/ Have appropriate keying.
3/ Set of tools. (Electricians)
4/ Multimeter.
5/ DC clampmeter.
6/ Copper sulphate reference cell and leads.
7/ Cleaning equipment.
8/ Gatic cover lifters.
9/ Rectifier load bank.
10/ PCS2000 Detection Equipment.

Labour:

One tradesperson electrical, one laborer, one vehicle.
Eight hours per site.

Procedure:

1/ Identify system.
2/ Check system for operation.
3/ Record voltmeter.
4/ Record ammeter.
5/ Record "on" potentials for all test points.
6/ Record "instant off" potentials for all test points.
7/ Record "off" potentials for all test points.
8/ Perform loop resistance and record.
9/ Check and record anode string currents.
10/ Load test rectifier for 10 minutes.
11/ Check all switchboard and testpoint terminals for tightness.
12/ Check all switchboard and testpoints are labelled and I.D. tags attached.
13/ Check plans are correctly drawn and modify if necessary.
14/ Remove and inspect anodes.
15/ Recheck all interference (CPS) bleeds.
16/ Pipecamp structure if applicable.
17/ Apply to reregister system if applicable

Brisbane Water Engineering Services

Electrical Engineering Unit

Cathodic Protection Potentials : Hockings St. River Crossing Sewer Main.

Date: 30th May 1999. System operating at 6.0 volts - 6.0 amps.

Natural potential of main to Cu/ CuSo4 Ref. Hockings St. side

Pipe No1	-455mv
Pipe No2	-450mv

Polarised potential of main to Cu/CuSo4 Ref. Hockings St side

	on	off
Pipe No1	-1052mv	-830mv
Pipe No2	-1125mv	-830mv

Polarised potential of main to Zinc Ref.in River Hockings St side

	on	off
Pipe No1	+58mv	+254mv
Pipe No2	+31mv	+255mv

Polarised potential of main Zinc Ref.calculated to Cu/CuSo4 Ref. Hockings St side

	on	off
Pipe No1	-1042mv	-846mv
Pipe No2	-1069mv	-845mv

Soil Resistivity at 2.0 metres Hockings St side

27.6 ohm/metres

Soil Resistivity at 5.0 metres Hockings St side

18.8 ohm/metres

Instrument used for testing was a Fluke meter BWES No 14

Tested by P. Smyth.

Brisbane Water Engineering Services

Electrical Engineering Unit

Ph. 34031838 Fx. 34031839
5 Bunya Street
Eagle Farm Q 4009

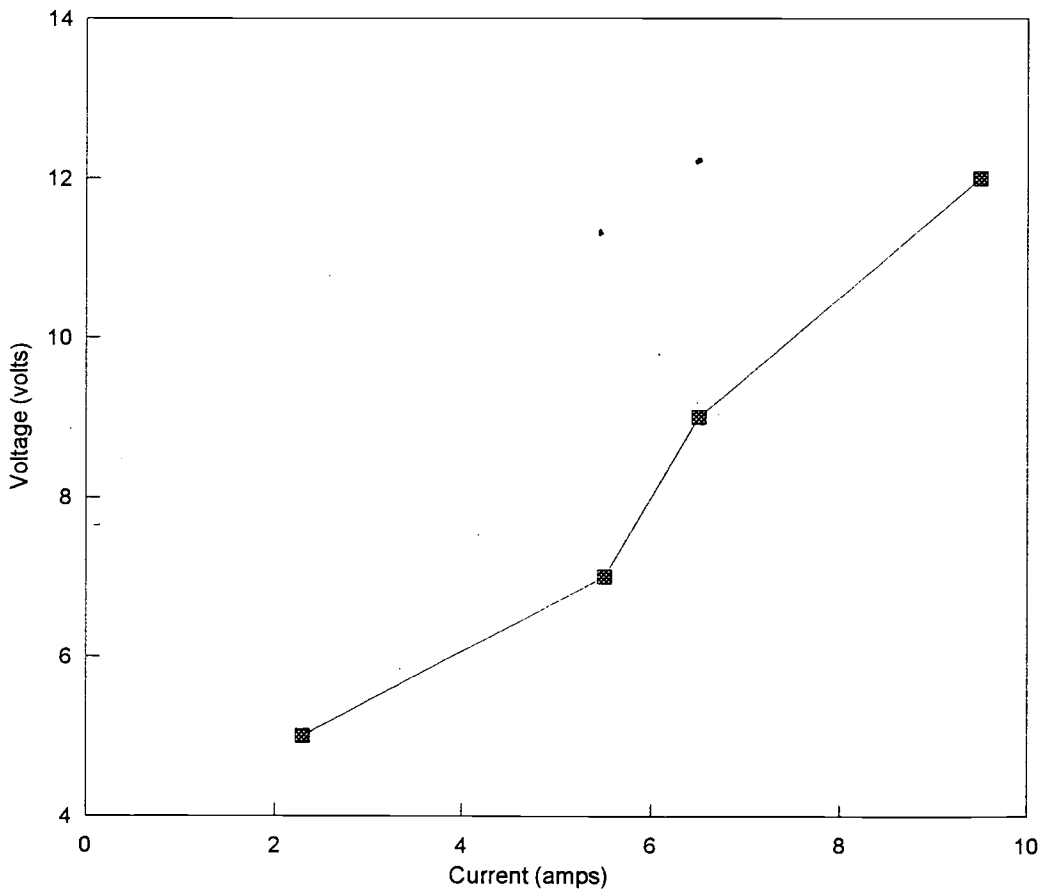
Cathodic Protection System Loop Resistance Hockings Street Rectifier. CPS165

Date: 10th July 1999
Cathodic Protection System: Hockings St River crossing Sewer Main.
System Operating Volts 6 System Operating amp 6

Test Voltage: (volts)	Test Current: (amps)
5	2.3
7	5.5
9	6.5
12	9.5

Loop Resistance (ohms)
1.384615

Graph of System voltage vs current.



16/07/99 LPHOCKS.WK4

Brisbane Water Engineering Services CP Form No. 27

Electrical Engineering Unit

Cathodic Protection Interference Survey Results Form

6.7amps

Project Hocking St **Unit Reading** 9.5v **Date** 30-4-99

	Reading	Test Point I. D.	Location	Swing
On	-295	Earth		
Off	-295	Peg	Wet well Earth	0
On	-1160		4 x Trade Waste Main	
Off	-1160	PIPE	Coro Drive	0
On	-504			
Off	-504	Light	Coro Drive	0
On	-582			
Off	-582	Lights	Coro Drive	0
On	-16	water		
Off	-16	Tap	Coro Drive	0
On	-555	Light		
Off	-555	Pole	22960 Coro Drive	0
On	-66	water		
Off	-66	tap 3a	Coro Drive	0
On	-566	Light		
Off	-566	45a7	Coro Drive	0
On	-591	Light		
Off	-591	22959	Coro Drive	0
On	-39	water		
Off	-39	tap 39	Coro Drive	0
On	-595	Light		
Off	-595	22958	Coro Drive	0
On	-523	Light		
Off	-523	22957	Coro Drive	0
On	-522	Light		
Off	-522	22956	Coro Drive	0
On	-49	water		
Off	-49	Pipe 3c	Coro Drive	0
On	-518	Light		
Off	-518	22955	Coro Drive	0

TESTED BY P SMYTH

Revision 09/28/95

Brisbane Water Engineering Services CP Form No. 27

Electrical Engineering Unit

Cathodic Protection Interference Survey Results Form

Project Hocking St **Unit Reading** 9.5 6.7a **Date** 30-4-99

	Reading	Test Point I. D.	Location	Swing
On	-544	Light		
Off	-544	229 5a	Coro Drive	0
On	-3	water		
Off	-3	Tap 29	Coro Drive	0
On				
Off				
On				
Off				
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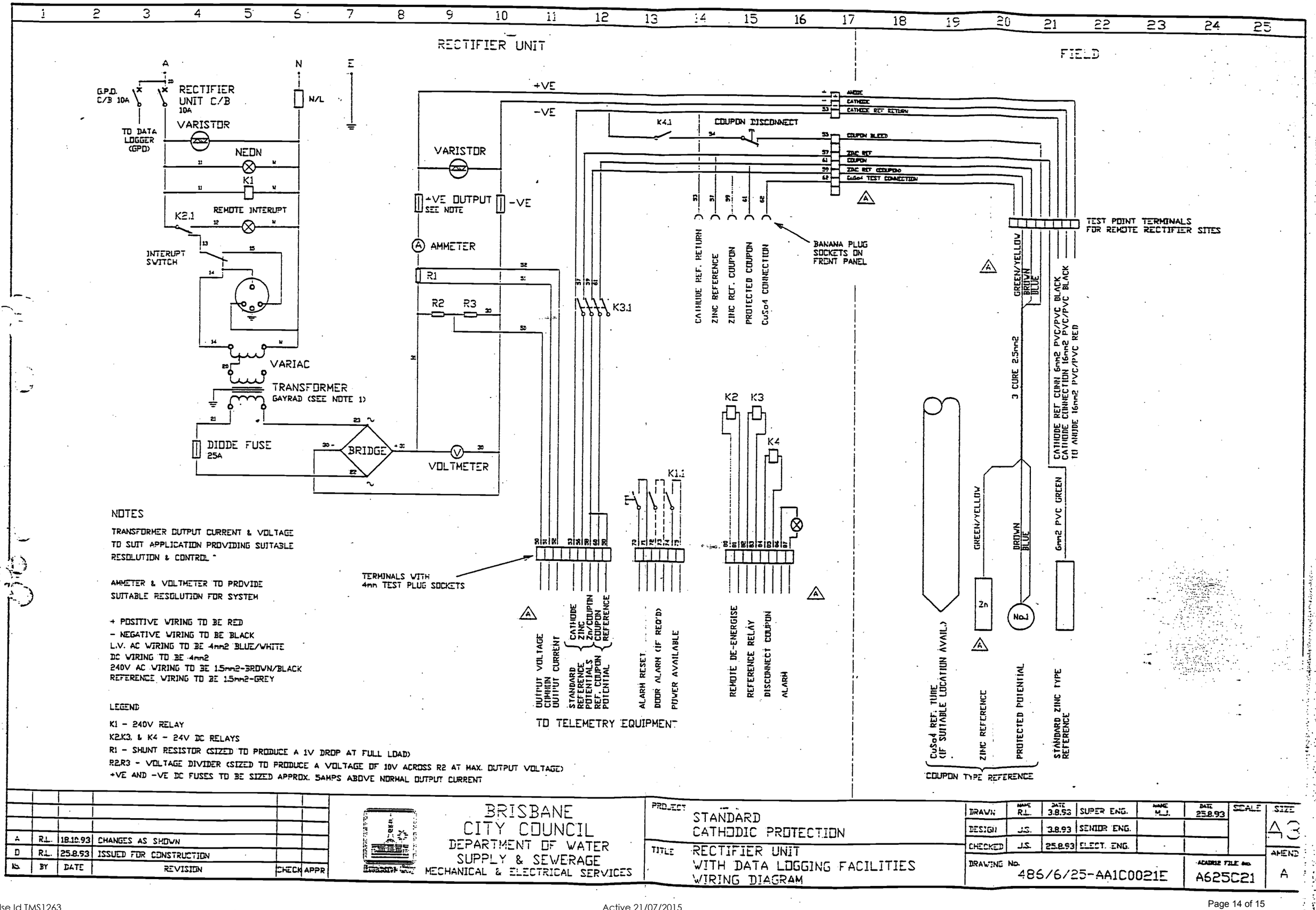
TESTED BY .....

Revision 09/28/95



NOTES

TRANSFORMER OUTPUT CURRENT & VOLTAGE TO SUIT APPLICATION PROVIDING SUITABLE RESOLUTION & CONTROL.

AMMETER & VOLTMETER TO PROVIDE SUITABLE RESOLUTION FOR SYSTEM

\+ POSITIVE WIRING TO BE RED
\- NEGATIVE WIRING TO BE BLACK
L.V. AC WIRING TO BE 4mm2 BLUE/WHITE
DC WIRING TO BE 4mm2
240V AC WIRING TO BE 1.5mm2-BROWN/BLACK
REFERENCE WIRING TO BE 1.5mm2-GREY

LEGEND

K1 - 240V RELAY
K2,K3, & K4 - 24V DC RELAYS
R1 - SHUNT RESISTOR (SIZED TO PRODUCE A 1V DROP AT FULL LOAD)
R2,R3 - VOLTAGE DIVIDER (SIZED TO PRODUCE A VOLTAGE OF 10V ACROSS R2 AT MAX. OUTPUT VOLTAGE)
+VE AND -VE DC FUSES TO BE SIZED APPROX. 5AMPS ABOVE NORMAL OUTPUT CURRENT

NO.	BY	DATE	REVISION	CHECK	APPR
A	R.L.	18.10.93	CHANGES AS SHOWN		
B	R.L.	25.8.93	ISSUED FOR CONSTRUCTION		

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY & SEWERAGE
MECHANICAL & ELECTRICAL SERVICES

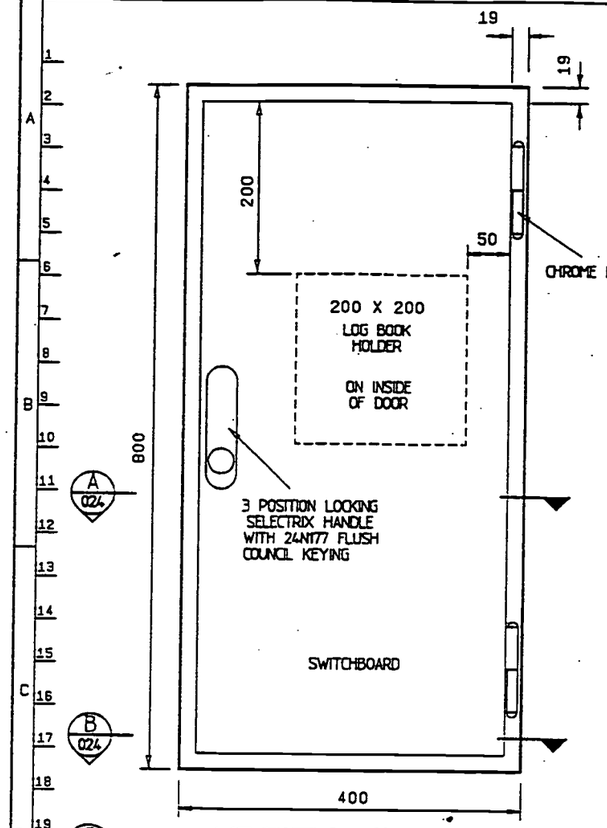
PROJECT: STANDARD CATHODIC PROTECTION

TITLE: RECTIFIER UNIT WITH DATA LOGGING FACILITIES WIRING DIAGRAM

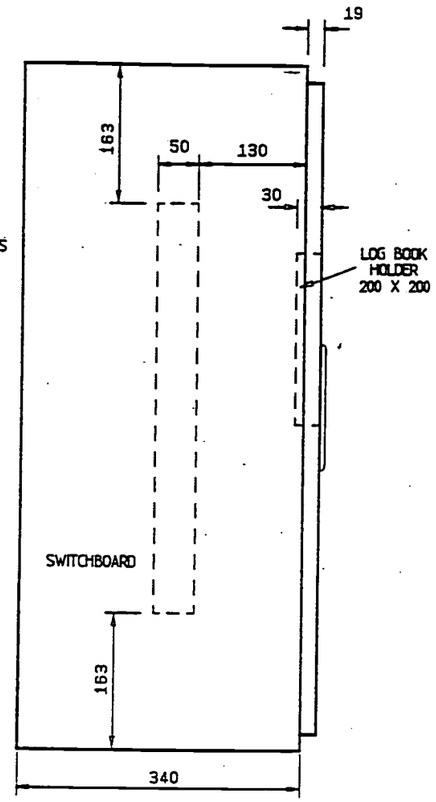
	NAME	DATE		NAME	DATE	SCALE	SIZE
DRAWN	R.L.	3.8.93	SUPER. ENG.	M.J.	25.8.93		A3
DESIGN	J.S.	3.8.93	SENIOR ENG.				AMEND
CHECKED	J.S.	25.8.93	ELECT. ENG.				A

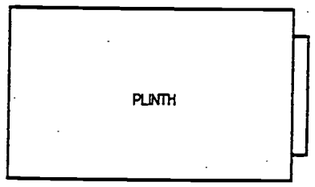
DRAWING No. 486/6/25-AA1C0021E

ACADRIX FILE No. A625C21

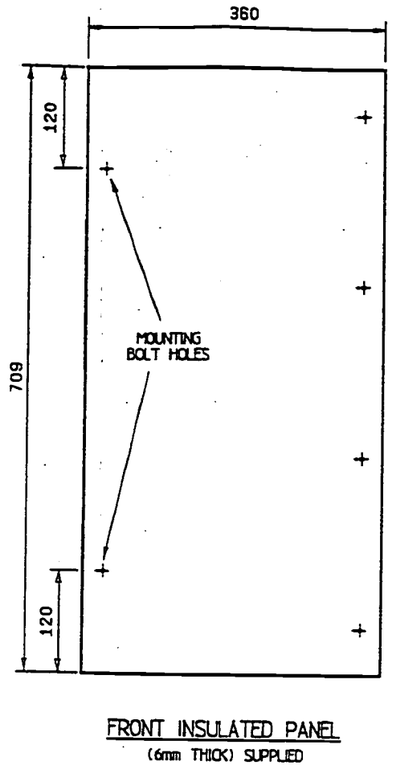


FRONT ELEVATION
SWITCHBOARD & PLINTH





SIDE ELEVATION
SWITCHBOARD & PLINTH



FRONT INSULATED PANEL
(6mm THICK) SUPPLIED

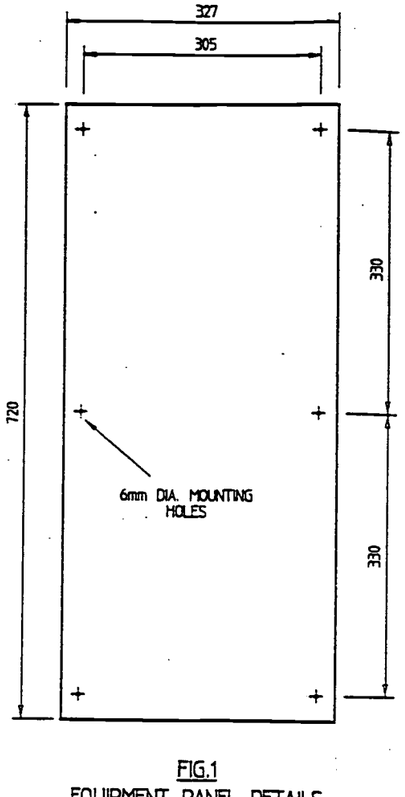
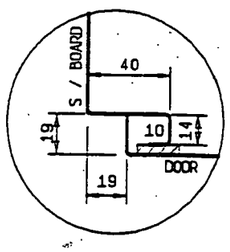
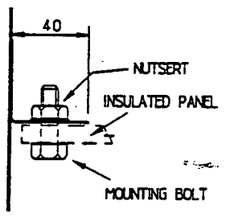


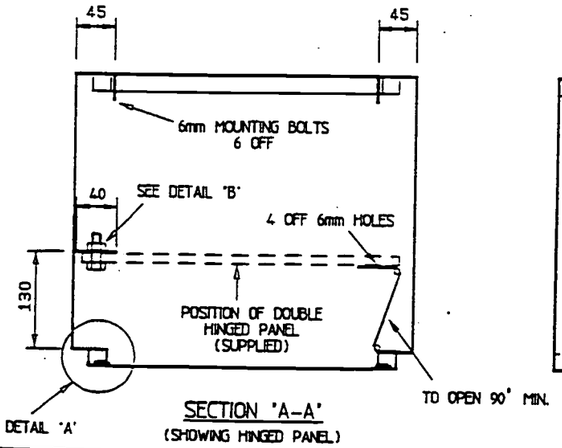
FIG.1
EQUIPMENT PANEL DETAILS



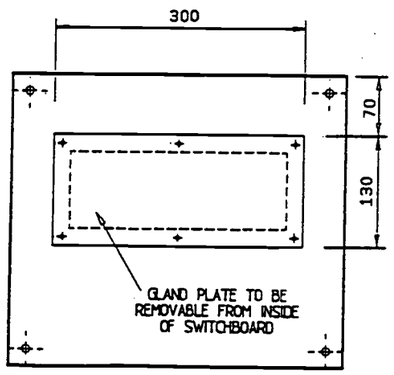
DETAIL 'A'
DOOR / CORNER DETAIL



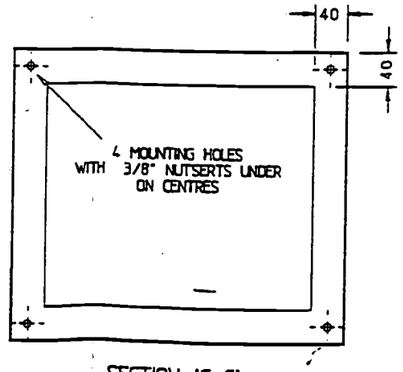
DETAIL 'B'



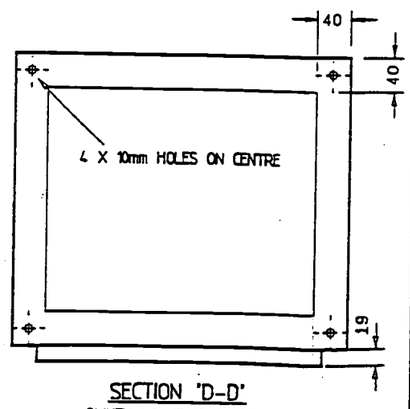
SECTION 'A-A'
(SHOWING HINGED PANEL)



SECTION 'B-B'
(SHOWING GLAND PLATE)



SECTION 'C-C'
PLINTH MOUNTING DETAILS



SECTION 'D-D'
PLINTH MOUNTING DETAILS

NUMBER OF
SWITCHBOARDS REQUIRED

NUMBER OF
PLINTHS REQUIRED

NOTES

1. CABINET TO BE MANUFACTURED FROM 1.6mm 316 2B STAINLESS STEEL.
2. UNLESS SPECIFIED. SUPPLY CABINET WITH PLINTH. (MOUNT PLINTH TO SWITCHBOARD CABINET USING STAINLESS STEEL SCREWS).
3. REAR EQUIPMENT PANEL TO BE ZINC PLATED STEEL. POWDER COATED "ORANGE". (FULL LENGTH & WIDTH & REMOVABLE). SEE FIG.1
4. DOUBLE HINGED PANEL SUPPLIED BY B.C.C.
5. PROVIDE 1/4" WW S.S. EARTH STUDS TO DOOR & SWITCHBOARD CABINET.
6. DEGREE OF WEATHER PROTECTION IP55.
7. SELECTRIX TYPE HANDLE TO BE SUPPLIED & FITTED BY SWITCHBOARD MANUFACTURER. HANDLE TO BE 1107 SS CU1
   KEY TO BE 1109071W
8. DOUBLE HINGED PANEL MOUNT TO BE SUPPLIED WITH MOUNTING BOLTS & NUTSERTS. TOP & BOTTOM. SEE DETAIL "A".

No	DATE	AMENDMENT	INITIALS
B	11.95	MODIFIED	O.L.P.
A	5.92	ISSUED FOR APPROVAL	O.L.P.

AMENDENT & ISSUE REGISTER

MANAGER	DIRECTOR OF TECHNOLOGY SERVICES
DATE:	DATE:

DIRECTOR OF PLANNING & DESIGN	DIRECTOR OF WATER SUPPLY	DIRECTOR OF CONSTRUCTION
DATE:	DATE:	DATE:

DESIGN	K.McG.	5.5.92	ENGINEER IN CHARGE
DRAWN	O.L.P.	7.5.92	SUPERVISING ENGINEER
TRACED			
CHECKED			A2 REDUCED

REFERENCES

CADD FILE No. 1220024B

THIS DRAWING WAS PRODUCED USING QIKDRAW

BRISBANE CITY COUNCIL
BRISBANE WATER
TECHNOLOGY SERVICES BRANCH
INFORMATION TECHNOLOGY

PROJECT:
CATHODIC PROTECTION

TITLE:
STANDARD
SWITCHBOARD CABINET

SCALE: N.T.S.	No. 1 OF 1 SHEETS

DRAWING No. 486/1/22-C0024E | AMEND. B

DEPOT ORIGINAL