



□ Electrical □ Mechanical □ Water Meters
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8th November.2000

OPERATING MANUAL FOR:

MILNE HILL to McDOWALL
S105 TRUNK MAIN
AND
MILNE HILL to ASPLEY P/ STN.
S84 TRUNK MAIN
CATHODIC PROTECTION SYSTEM

CLIENT:

BRISBANE WATER
WATER SYSTEM SERVICES

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DRAWINGS

486/6/25-AA1C0021E	Standard Rectifier Wiring Diagram
(No Number)	Monthly Maintenance Program

(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: 600mm & 755mm Dia mild steel cement lined.

Coating: Low Density Fusion Bonded Polyethylene Coated.

Length: Appox 1.5 Km.(S105) and approx 1.1Km (S84)

Location: From cnr Hamilton and Beckett Rds to Valve 994 Hamilton Rd. (S105)
From Valve 994 Hamilton Rd. to Valves 716/ 717 Aspley Pump
Station.(S84)

Construction

Drawings:

486/1/22-CC0024E Cathodic Protection Standard Switchboard Cabinet

486/1/22-AA1T0001E Cathodic Protection Test Points

(4.0) **CATHODIC PROTECTION DETAILS**

- (4.1) Type of Cathodic Protection: Impressed Current.
- (4.2) Rectifier: Standard 32 Volt, 15.0 amp direct current output enclosed in a stainless steel switchboard. This system has 1 rectifier installed. The rectifier has a 240V supply from a nearby water booster switchboard (WB118). The rectifier is located nearby water booster WB118 at the intersection of Hamilton and Trouts Rd. McDowall UBD map119 D12.
- (4.3) Cathode: The cathode point is located adjacent to the 600 mm dia sluice valve at Trouts and Hamilton Rds where a type D test point has been installed. The cathode point is where the cabling from the rectifier is attached to the structure under cathodic protection.
- (4.4) Anodes: Two 1500 x 75mm silicone iron anodes were installed approximately 21.0 metres from the trunk mains, in a horizontal bed . The anodes are backfilled with cokebreeze thereby improving anode - ground resistance. The anodes are identified by a marker post and label. See layout drawing.
- (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 eight test points have been installed on the trunk main which can be identified from the layout drawing.
- (4.6) Associated Drawings:
Cathodic Protection Test Point Details - 486/1/22-AA1T0001E
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 trunk 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.

25th July, 2000.

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.

8th November, 2000.

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.

8th November, 2000
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

Ph. 34031838 Fx. 34031839

Electrical Engineering Unit5 Bunya Street
Eagle Farm Q 4009Cathodic Protection System Loop Resistance

Date: 8th November 2000

Cathodic Protection System:

Milne Hill Trunk Main

System Operating Volts

3.9

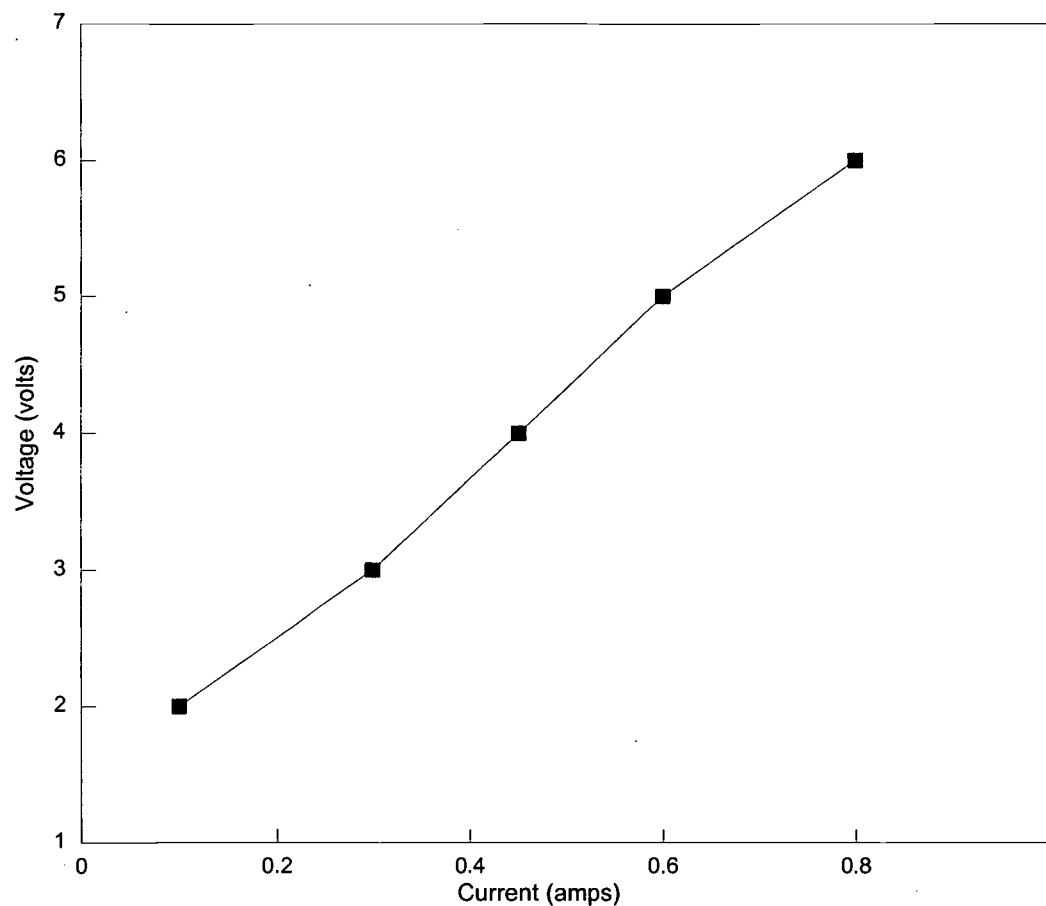
System Operating amps

0.4

Test Voltage: (volts)		Test Current: (amps)	
2		0.1	
3		0.3	
4		0.45	
5		0.6	
6		0.8	

Loop Resistance (ohms)

5.714286

Graph of System voltage vs current.

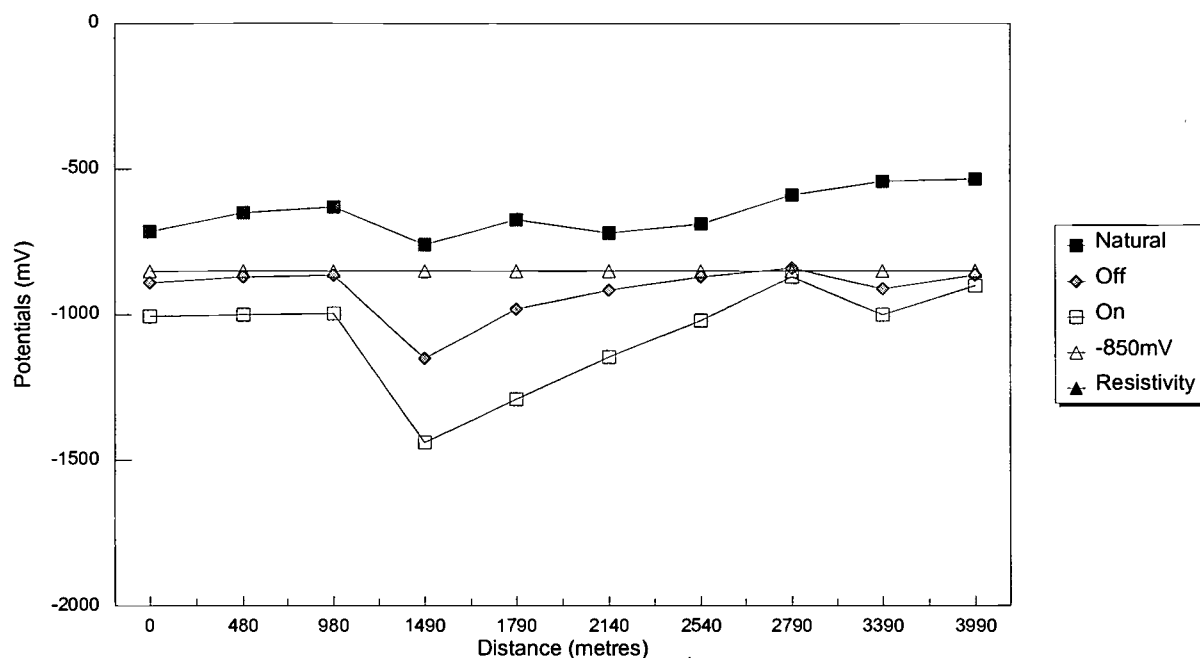
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CP Form No. 23

Electrical Engineering Unit**Cathodic Protection System Potential Recording Form****Project** Milne Hill to McDowall / Aspley Res. T/Main S105 & S84.**Date** 14th Nov. 2000

Test Point number	Distances to T.P. (metres)	Potentials to CuSO4			Resistivities at 2 metres (ohm.metres)
		Natural (mV)	Off (mV)	On (mV)	
1	0	-715	-890	-1005	105.5
2	480	-650	-870	-1000	94.2
3	980	-630	-865	-995	148.2
4	1490	-760	-1150	-1440	130.1
5	1790	-675	-980	-1290	53.9
6	2140	-720	-915	-1145	53.9
7	2540	-690	-870	-1020	55.2
8	2790	-590	-840	-870	133.1
9	3390	-542	-910	-1000	98
10	3990	-535	-865	-900	37.6

Graph of potentials and resistivity vs pipelength



Rectifiers located at 1490 Metres.

Potbany.wk4

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Brisbane Water Engineering Services

CP Form No. 23

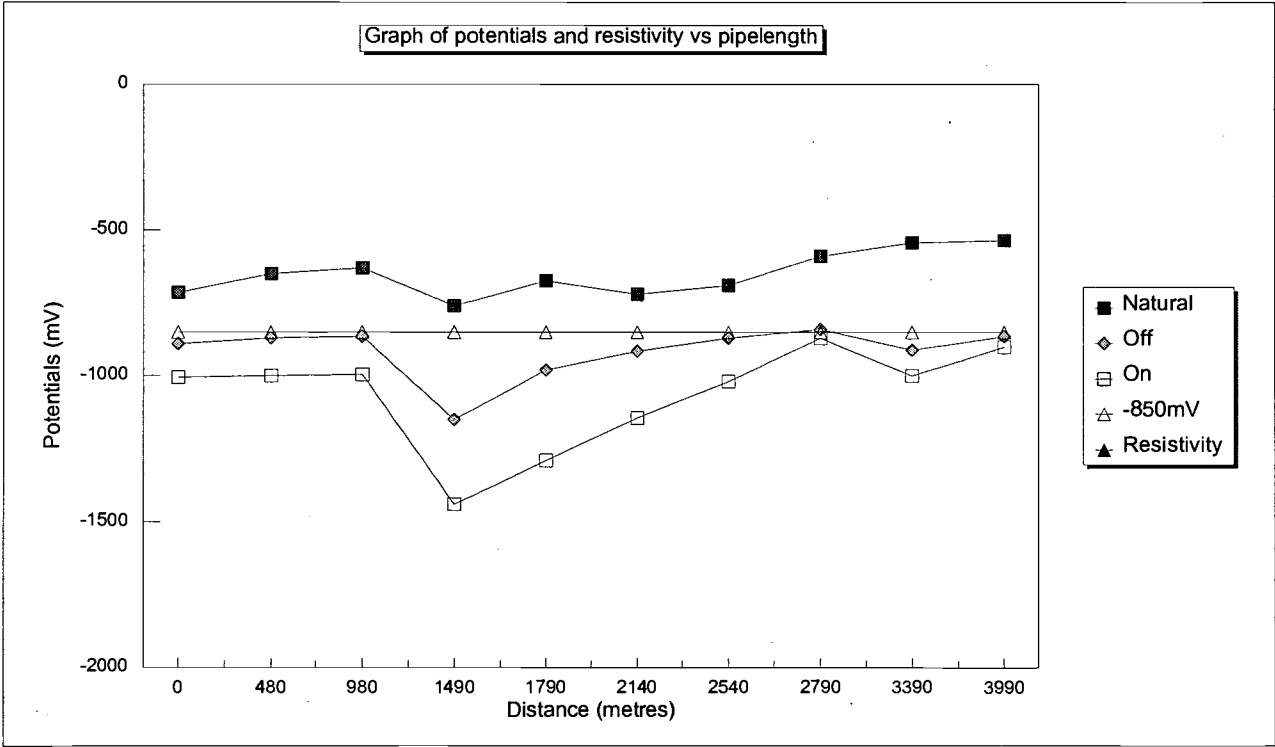
Electrical Engineering Unit

Cathodic Protection System Potential Recording Form

Project Milne Hill to McDowall / Aspley Res. T/Main S105 & S84.

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Rectifiers located at 1490 Metres.