14TH APRIL 1993

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY AND SEWERAGE
MECHANICAL AND ELECTRICAL BRANCH
ELECTROLYSIS SECTION
EAGLE FARM PUMPING STATION

OPERATING MANUAL FOR:

WACOL WASTEWATER TREATMENT PLANT FINAL SETTLING TANKS 1,2,3 & 4 CATHODIC PROTECTION SYSTEMS.

CLIENT:

DEPARTMENT OF WATER SUPPLY AND SEWERAGE –
SEWERAGE OPERATIONS BRANCH

MANUAL CONTENTS

DRAWINGS

JE02/104	Standard Rectifier Wiring Diagram
486/7/5-JB1C0025E	Cathodic Protection Details
(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 and 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) STRUCTURE DETAILS

Size: Final Settling tank scraper bridge.

Coating: Painted and galvanized mild steel.

Length: not applicable

Location: Rear of treatment plant, Grindle rd. Wacol UBD Map 50 C3

Construction Drawings:

(4.0) CATHODIC PROTECTION DETAILS

(4.1) Type of Cathodic Protection: Impressed Current.

(4.2) Rectifier: Standard 12V Volt, 8 amp direct current output enclosed in a stainless steel switchboard. Rectifier has a 240V supply from bridge switchboard.

(4.3) Cathode: The cathode point is located adjacent to the trunk mains at the rectifier site where a type B 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:There are four strings of anodes with two anodes per string protecting the main structure and two secondary strings of one anode protecting the centre of the bridge. Refer dwg no 486/7/5–JB1C0025E

(4.5) Test Points: Test points have not been installed and potentials are monitored using a portable copper sulphate reference cell.

(4.6) Associated Drawings:

Cathodic Protection Details	– 486/7/5–JB1C0025E
Cathodic Protection Test Point Details	– 2/14.199
Standard Rectifier Wiring Diagram	– JE02/104

(4.7) Associated Standards:

AS 3000 1986 Australia Wiring Rules

AS 2832.1 1985 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) Rectifier Loop Resistance.

(6) Foreign Structure Interference Survey and Mitigation.

(7) Final Potential Survey and Commissioning.

NOTE: Details of above testing have not been included in this manual but are available upon request.

(6.0) CONCLUSION

Full Cathodic protection has been achieved on this section of trunk mains. The cathodic protection system is registered with the Queensland Electricity Commission 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.

Electrical Workshop
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.

Electrical Workshop
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.

Electrical Workshop
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 for "continue to operate" permit if applicable.

BRISBANE CITY COUNCIL

MEMORANDUM

To	File No.
From	Date 6/10/92
Subject WACOL T.P. PICKET FENCE THICKNER N°2 PIMMS – SWB 111	

NATURAL – 408 MV to $CuSO_4$ REF.

UNIT READING 3 VOLTS AT 1 AMP.

READINGS SW BD END

$CuSO_4$ to STRUCTURE	ON	: – 1260 MV
	OFF	: – 1024 MV
	INST OFF	: – 1160 MV

READINGS CENTRE

$CuSO_4$ to STRUCTURE	ON	: – 1295 MV
	OFF	: – 1078 MV
	INST. OFF	: – 1195 MV

READINGS FAR END

$CuSO_4$ to STRUCTURE	ON	: – 1250 MV
	OFF	: – 1020 MV
	INST OFF	: – 1150 MV

ANODE CURRENT

(1) 0·10 A
(2) 0·44 A
(3) 0·45 A.

BRISBANE CITY COUNCIL

MEMORANDUM

To	File No.
From	Date 6/10/92
Subject WACOL T.P. PICKET FENCE THICKNER N° 2	

LOOP RESISTANCE

2V at 0·1A	✓ / I	= (10-6) / (4-2)
4V at 1·0A		
6V at 2·0A		4 / 2
8V at 2·9A		
10V at 4·0A.		= 2Ω LOOP RESISTANCE.

INTERFERENCE

BRIDGE SW. BD. SIDE	ON	- 64·5 mV
	OFF	- 61·9 mV
	SWING	- 2·6 mV
OPP SIDE	ON	- 131·3 mV
	OFF	- 142·8 mV
	SWING	+ 11·5 mV

BRISBANE CITY COUNCIL

MEMORANDUM

To	File No.
From	Date 6/10/92
Subject WACOL T.P. CLARIFIER N° 3 PIMM - SWB 103	

UNIT READING 3 VOLTS at 1.0 AMPS

READINGS SW BD END

$CuSO_4$ to STRUCTURE	ON	-1250 MV
	OFF	-1079 MV
	INST OFF	-1170 MV

READINGS CENTRE

$CuSO_4$ to STRUCTURE	ON	-1420 MV
	OFF	
	INST OFF	-1270 MV

READING FAR END

$CuSO_4$ to STRUCTURE	ON	-1180 MV
	OFF	
	INST OFF	-1140 MV

ANODE CURRENT

(1) 0.35 AMP

(2) 0.73 AMP.

BRISBANE CITY COUNCIL

MEMORANDUM

To	File No.
From	Date 6/10/92
Subject WACOL T.P. CLARIFIER N° 3	

LOOP RESISTANCE

2V at 0.5 amps
4V at 1.5 amps
6V at 2.0 amps
8V at 3.0 amps
10V at 4.0 amps

INTERFERENCE

BRIDGE SW BD SIDE
ON -111.2MV
OFF -106.9MV
SWING -4.3MV

OPP SIDE
ON -148.1 MV
OFF -142.3 MV
SWING -5.8 MV

BRISBANE CITY COUNCIL

MEMORANDUM

To	File No.
From	Date 22/09/92

Subject WACOL T/P :- CLARIFIER N°4 (PIMMS - SWB 110)

Rectifier set at 5V 1.5A

POLARIZED

READINGS :- SWITCHBOARD END

$CuSO_4$ to STRUCTURE -1378 mV on

-1129 mV off

INSTANT OFF -1178 mV

- CENTRE TANK

$CuSO_4$ to STRUCTURE -1554 mV on

-1162 mV off

INSTANT OFF 1179 mV

- FAR END

$CuSO_4$ to STRUCTURE -1479 mV on

-1232 mV off

INSTANT OFF 1249 mV

ANODE CURRENT 1 1.10A

2 .580mA

LOOP RESISTANCE

2V	250 mA
4V	1A
6V	1.75A
8V	2.6A
10V	3.5A

UNPOLARIZED

READINGS :- SWITCHBOARD END -1214 mV on

-994 mV off

BRISBANE CITY COUNCIL

MEMORANDUM

To	File No.
From	Date 22/09/92

Subject WACOL T/P :- CLARIFIER N° 4

CENTRE TANK - 1514 mV on
- 1035 mV off

FAR END - 1205 mV on
- 981 mV off

INTERFERENCE
BRIDGE SW BD SIDE
ON - 188.7 MV
OFF - 184.9 MV
SWING - 3.8 MV

Opp SIDE
ON - 197.3 MV
OFF - 193.2 MV
SWING - 4.1 MV