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11TH NOVEMBER, 1992

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

OPERATING MANUAL FOR:

NUDGEE BEACH PACKAGE PLANT TANK BASE CATHODIC PROTECTION SYSTEM.

CLIENT:

DEPARTMENT OF WATER SUPPLY AND SEWERAGE
SEWERAGE OPERATIONS BRANCH.

MANUAL CONTENTS

DRAWINGS

(1.0) INTRODUCTION

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

Because of this, precaution must be taken to stop or minimise 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) TANK BASE DETAILS

Size: Mild steel painted tank 9.15 X 3.7 metres.

Coating: On base ?

Length: not applicable

Location: Nudgee Beach Off O'Quinn Street UBD9 J7

Construction Drawings: Nil.

(4.0) CATHODIC PROTECTION DETAILS

(4.1) Type of Cathodic Protection: Impressed Current.

(4.2) Rectifier: Standard 32V Volt, 15 amp direct current output enclosed in a stainless steel switchboard. Rectifier has a 240V supply from a nearby switchboard. Rectifier is located at the top of stairs on package plant.

(4.3) Cathode: The cathode point is located adjacent to the switchboard on the tank.

(4.4) Anodes: Four 230 X 40 dia. silicone iron anodes were installed approximately 0.6 metre from the tank in a vertical bed. The 1.5 metre deep anodes were first backfilled with cokebreeze thereby improving anode - ground resistance. The anodes are identified by a label. Refer attached sketch.

(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) Soil Resistance Testing.

(3) Current Drain Survey.

(4) Rectifier Loop Resistance.

(5) Foreign Structure Interference Survey and Mitigation.

(6) 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**

Cathodic Protection was installed on the external section of the Package Plant as holes were being detected in the surface area that was in contact with the concrete foundations.

Using a $CuSO_4$ reference to the structure the following natural potentials were obtained before the external protection was energised. From the layout drawing the R..., is the location where the reference reading was taken.

The system was energised and the "ON" potentials were recorded in the same locations. The rectifier unit was set at 4.0 volts at 6.25 amps. The chart below gives the location and comparison between natural and "ON" potentials.

Potentials to copper sulphate reference cell and tank base.

LOCATION	NATURAL	"ON"
R1 & R2	-430MV	-940MV
R3 & R4	-440MV	-1005MV
R5 & R6	-425MV	-920MV
R7 & R8	-425MV	-780MV

R1 & R2 Incoming End of Tank

R3 & R4 Centre Area of Tank

R5 & R6 Baffle End of Tank

R7 & R8 Incoming and Outflow Pipes

* Refer site plan for Nudgee Beach Package Plant

From these potential readings protection for the external tank and pipework has been achieved. The internal tank still has its protection as this was not interfered with in adding the extra protection for the external tank.

(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.

12th October 1992
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.

13th October 1992
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.

13th October 1992
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.

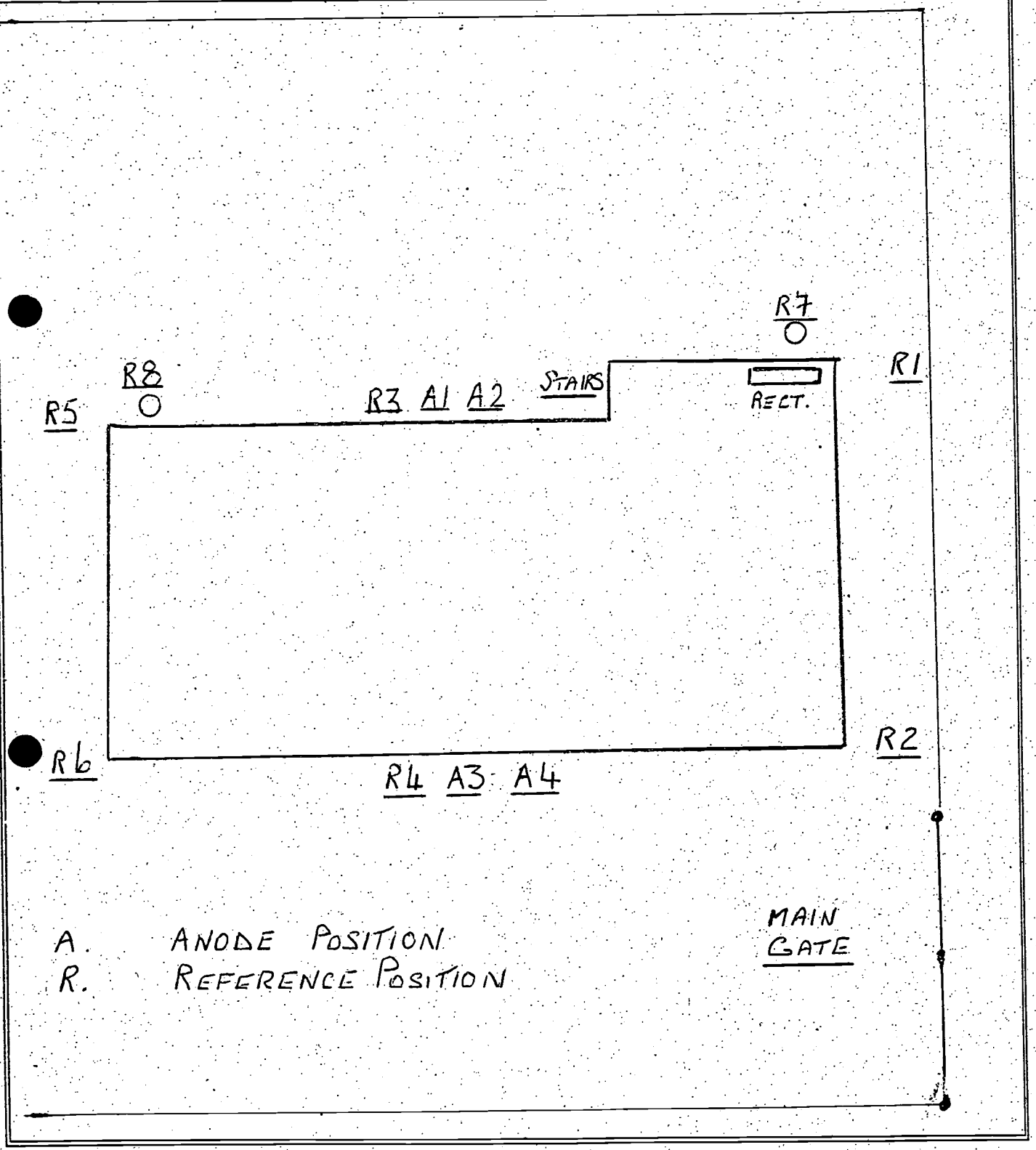
Procedure:

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
Dept of Water Supply and Sewerage
Eagle Farm Pump Station
Electrical Workshop

Date: 26-11-93

Site Plan for: NUDGEE BEACH PACKAGE PLANT.



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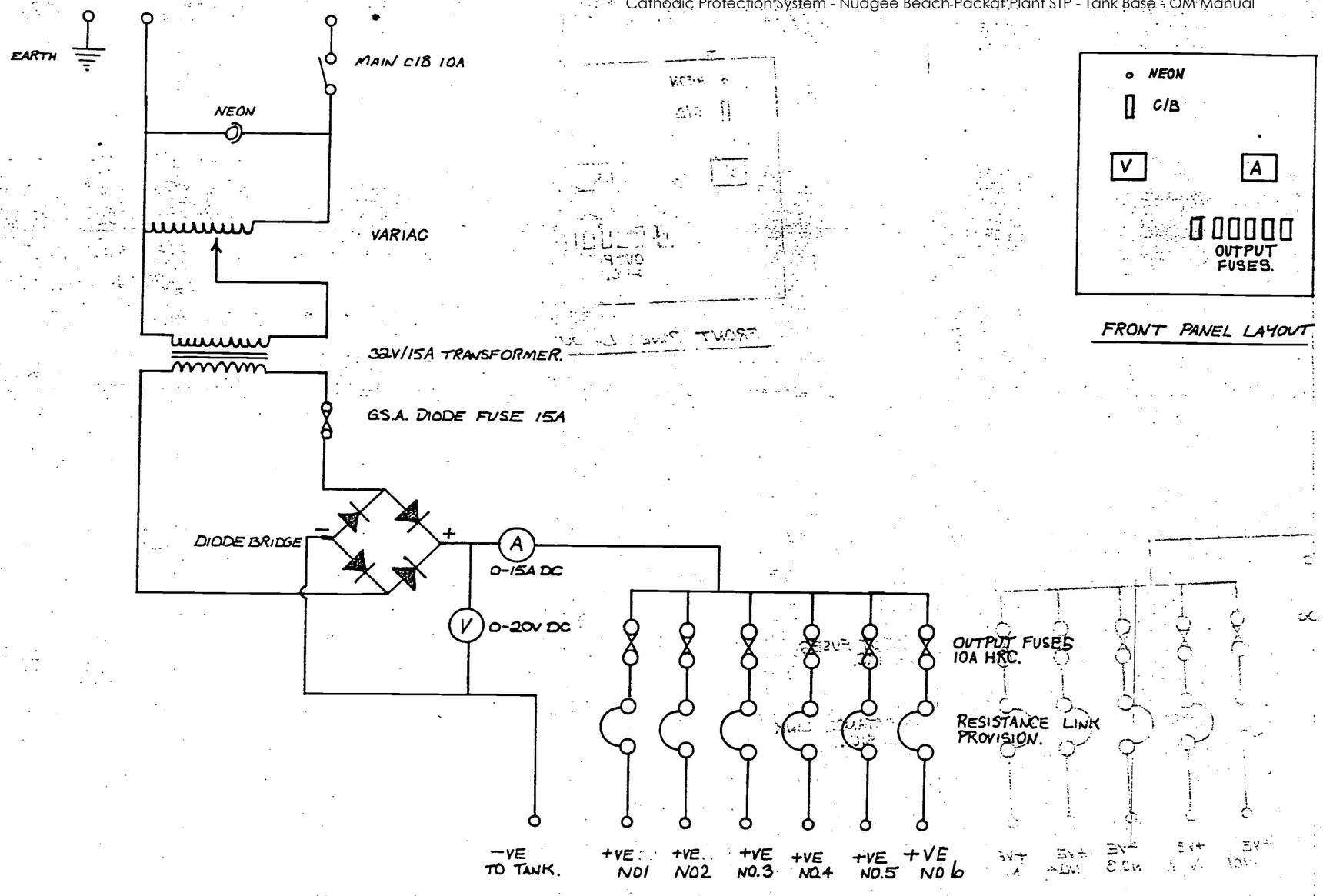
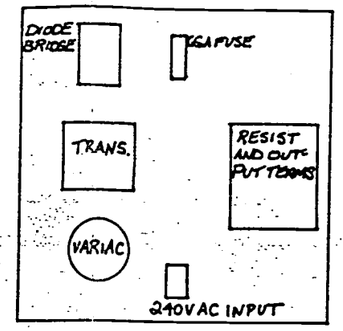


FRONT PANEL LAYOUT



BACK PANEL LAYOUT

DC. OUTPUT FUSES

N°1	TANK BASE AND PIPEWORK
N°2	FRONT TANK
N°3	MID TANK
N°4	MID TANK
N°5	V TANK
N°6	BAFFLES TANK.

CHIEF ENGINEER & MANAGER	ENGINEER FOR DESIGN	DESIGN	K.M.	23.6.87	ENGINEER IN CHARGE
	CONSTRUCTION ENGINEER	DRAWN	K.M.	27.8.87	ASST/ENG.
		TRACED	K.M.	27.8.87	LEVEL BOOK
		CHECKED	M.G.	26.8.87	FIELD BOOK
		A.H. DATUM			SURVEY

BRISBANE CITY COUNCIL
DEPARTMENT OF WATER SUPPLY & SEWERAGE

NUDGEE BEACH PACKAGE PLANT TANK CATHODIC PROTECTION SWITCHBOARD DETAILS.

SCALE: N.T.S | SHEET , OF SHEETS | DWG. NO. 2/14·210.211