

☐ Electrical ☐ Mechanical ☐ Water Meters
25 Bunya Street Eagle Farm Q 4009
Ph. (07) 3403 1849
Fx. (07) 3403 1898

Brisbane Water Engineering Services

1st July 1997

OPERATING MANUAL FOR:

GREENDALE WY SUBMERSIBLE PUMP STATION
SP 272

CLIENT:

**BRISBANE WATER
SEWERAGE UTILITY SERVICES**

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486/7/7/-TK1C2247E	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) PUMP DETAILS

Size: 2 X 5.9 Kw submersible pumps

Coating: Enamel coated.

Length: NA

Location: Greendale Wy Carindale
UBD 182 E 10

**Construction
Drawings:**

486/6/25-AA1C0023E

Cathodic Protection Rectifier Unit.

(4.0) CATHODIC PROTECTION DETAILS

- (4.1) Type of Cathodic Protection: Impressed Current.
- (4.2) Rectifier: Standard 32 Volt, 10 amp direct current output enclosed in a PVC board inside the stainless steel switchboard. Rectifier has a 240V supply from the stainless steel switch board distribution panel.
- (4.3) Cathode: The cathode point is located on the pump motor. One reference anode is also fitted to the motor on the side. The cathode point is where the cabling from the rectifier is attached to the structure under cathodic protection.
- (4.4) Anodes: One silicone iron anode is suspended from roof of the well . See layout drawing.
- (4.5) Test Points: Test points are installed on cathodically protected structures to enable testing to ensure full protection of the pumps. On these pumps test points have been brought out to the cp switch board.
- (4.6) Associated Drawings:
Cathodic Protection Details - 2/14.213
Standard Rectifier Wiring Diagram - 486/6/25-AA1C0023E
- (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) Current Drain Survey.
- (4) Rectifier Loop Resistance.
- (5) Foreign Structure Interference Survey and Mitigation.
- (6) Final Potential Survey and Commissioning.

(6.0) CONCLUSION

Full Cathodic protection has been achieved on these pumps and well equipment . 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 pump to water potentials.

1 St. July 1997.

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 trades person, 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.

1 St. July 1997.
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 trades person electrical, one labourer, 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.

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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 trades person electrical, one labourer, 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 test point terminals for tightness.
- 12/ Check all switchboard and test points 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 re-register system if applicable

Brisbane Water Engineering Services

CP Form No. 39

Electrical Engineering Unit**Submersible Pump Station Potentials****Project** Greendale Wy Carindale**Date** 01/06/97**Unit set at** 2 Volts 0.07 Amps**Cathode current**

Pump 1	88.8ma
Pump 2	88.8ma

Potentials to copper sulphate reference cell

	<u>Natural (mV)</u>	<u>On (mV)</u>	<u>Off (mV)</u>
Pump 1	-690	-1002	-890
Pump 2	-690	-1002	-785
Ladder	-690	-1010	-890

Potentials to associated zinc fixed reference cells

		<u>Natural (mV)</u>	<u>On (mV)</u>	<u>Off (mV)</u>
Zn	Ladder	-360	-140	-240
Zn 1.1	Pump 1	-360	-146	-243
Zn 2.1	Pump 2	-422	-42	-220

Insulated Joints**Location** Hose between pump and outlet pipe**Flange to Flange Resistance****Flange to Bolt Resistance**

Pipe 1	NA	NA
Pipe 2	NA	NA

Insulated Joints**Bolts**

Number	NA
Size	NA
Length	NA

Interference Testing Nil interference to foreign structures

COMPILED BY.....J Taylor

Brisbane Water Engineering Services

Cp Form No 24

Electrical Engineering UnitCathodic Protection System Loop Resistance

Date 1 st July 1997

Cathodic Protection System:

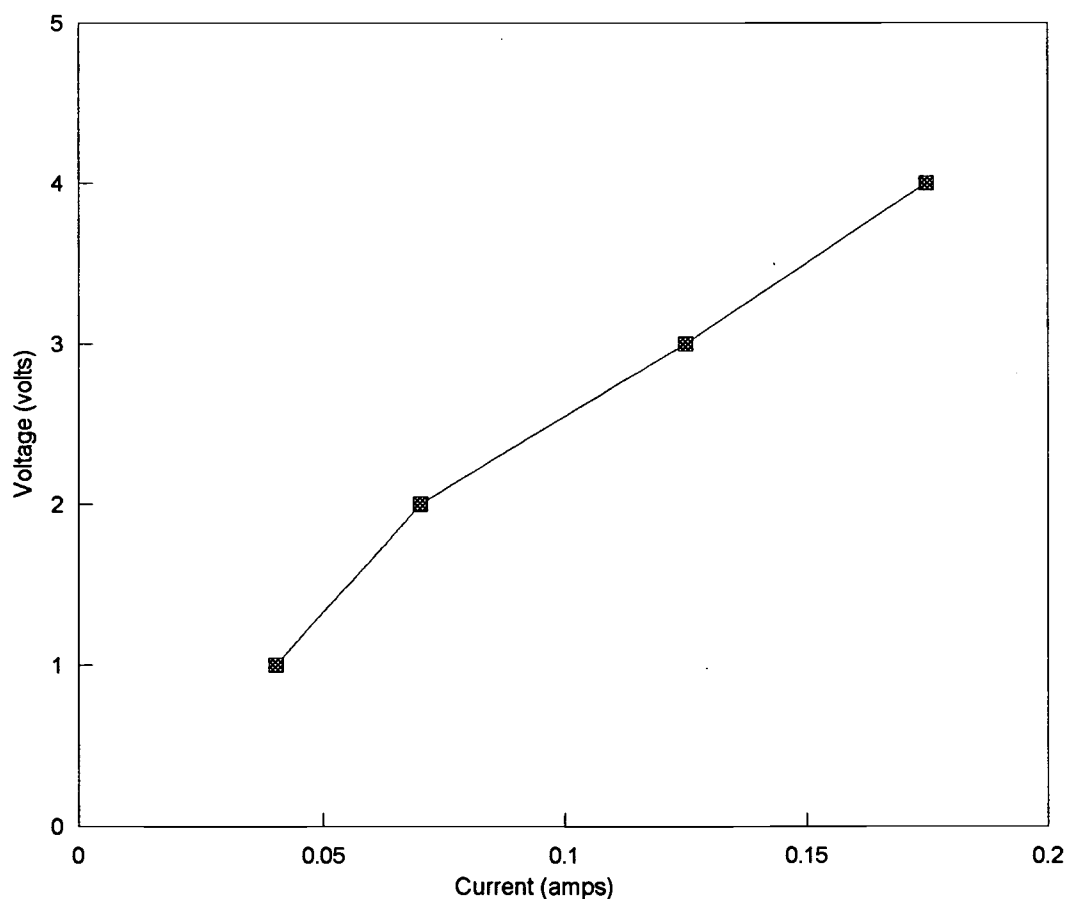
Greendale Wy Submersible Pump Station

System Operating Volts: 2

System Operating amps 0.07

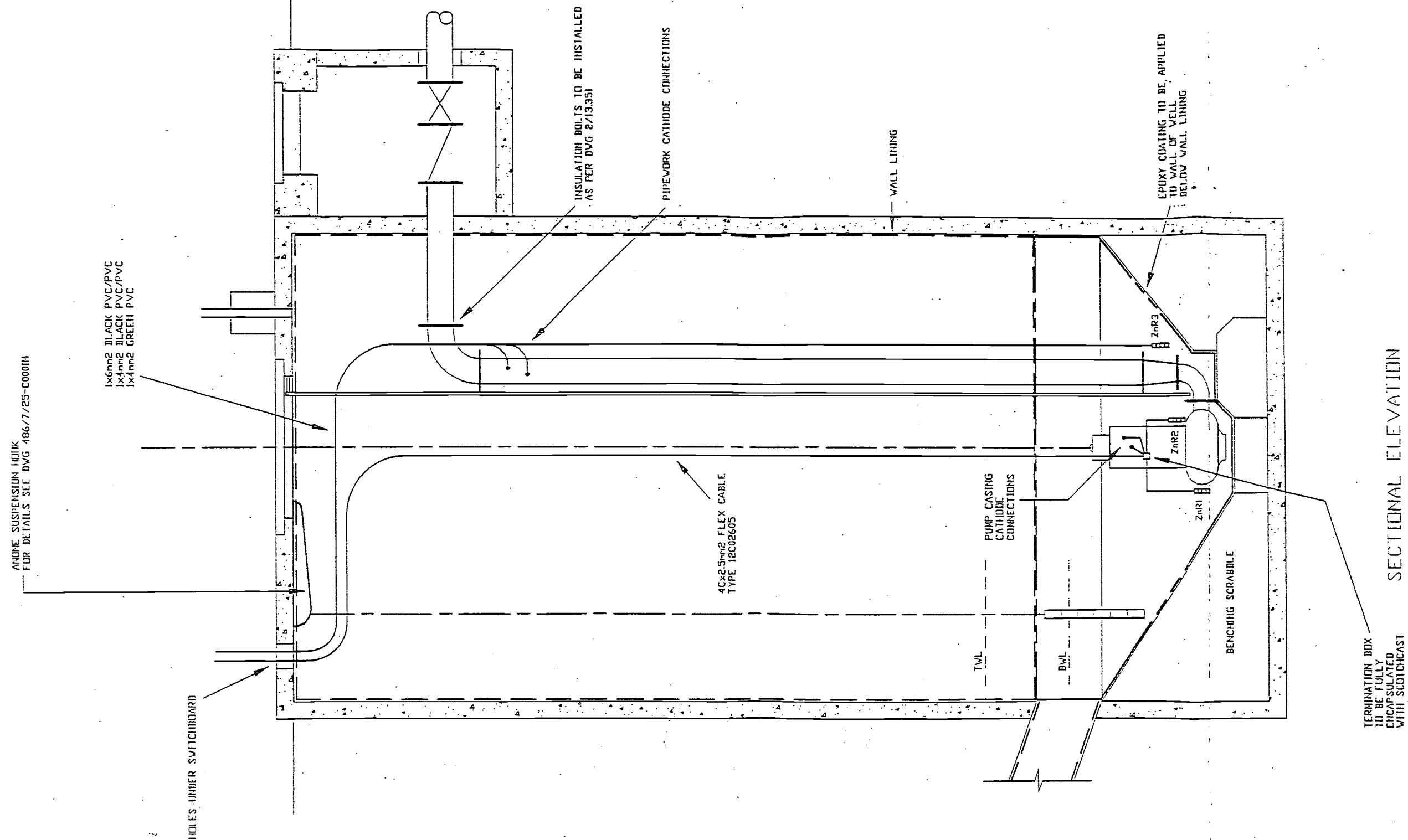
Test Voltage:		Test Current:	
(volts)		(amps)	
1		0.04	
2		0.07	
3		0.125	
4		0.175	


Loop Resistance (ohms)
24

Graph of System voltage vs current.

06/30/97


LPGNDAL.WK4



O	16.12.93	ISSUED FOR CONSTRUCTION	R.L.	MANAGER		DIRECTOR OF PLANNING & DESIGN		DESIGN			PROJECT		 BRISBANE CITY COUNCIL DEPARTMENT OF WATER SUPPLY AND SEWERAGE MECHANICAL & ELECTRICAL SERVICES		
				DATE:		DATE:		DRAWN	R.LISTON	16.12.93	OXLEY ARCHERFIELD CATHODIC PROTECTION				
				DIRECTOR OF CONSTRUCTION		DIRECTOR OF M & E SERVICES		CHECKED			TITLE				
						DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION		ENGINEER IN CHARGE		SUBMERSIBLE PUMP STATION GENERAL LAYOUT					
								SUPERVISING		CLASS FILE No. 477551					
												SCALE: NTS		No. 1 OF 1 SHEETS	
												DRAWING No.		AMEND.	
												486/7/7-PF1C0051E		0	



PROJECT	SP265 BILLAN ST. 30KW SEWAGE SUBMERSIBLE PUMP STATION 2 PUMP RAIL MOUNTED
TITLE	RECTIFIER UNIT WIRING DIAGRAM

DRAWN	NAME P.L.	DATE 24.4.95	SUPER ENG.	NAME	DATE	SCALE	
DESIGN	J.S.	24.4.95	SENIOR ENG.				
CHECKED			ELECT. ENG.				
DRAWING No.						ACAD12 FILE No.	
486/7/7-TK1C2247E						77022-7-	